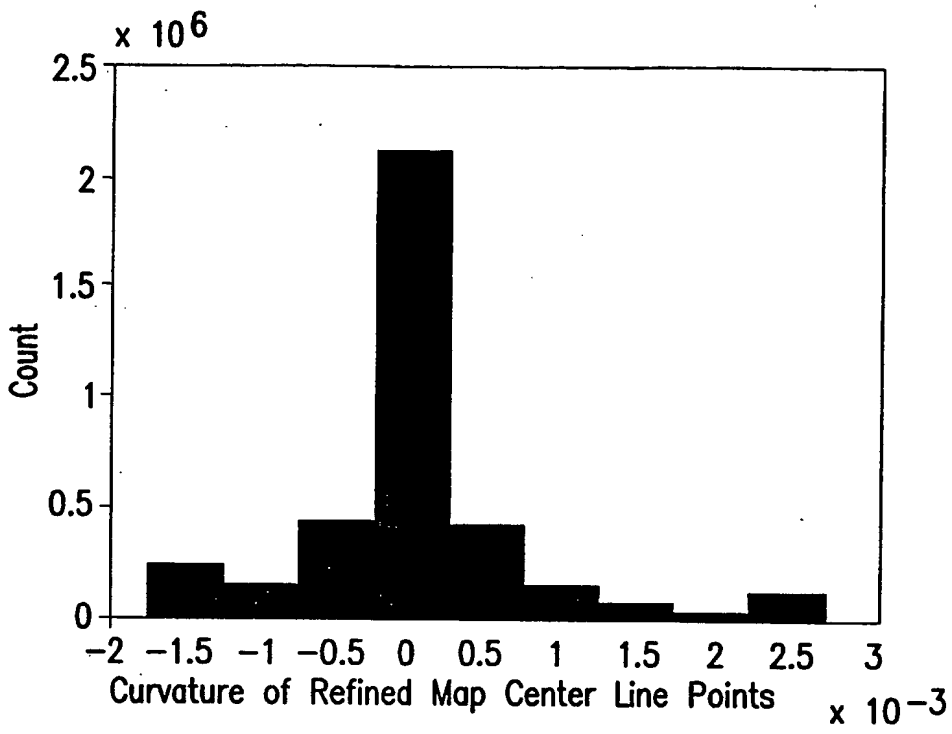

x 10^6
2.5
2
1.5
1
0.5
0
Count
−2 −1.5 −1 −0.5 0 0.5 1 1.5 2 2.5 3
Curvature of Refined Map Center Line Points
x 10−3

FIG.1

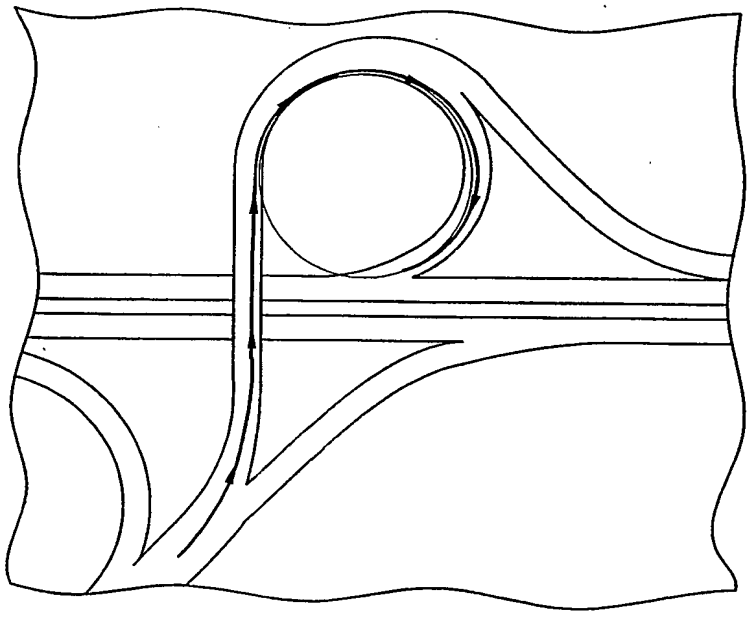


FIG.2

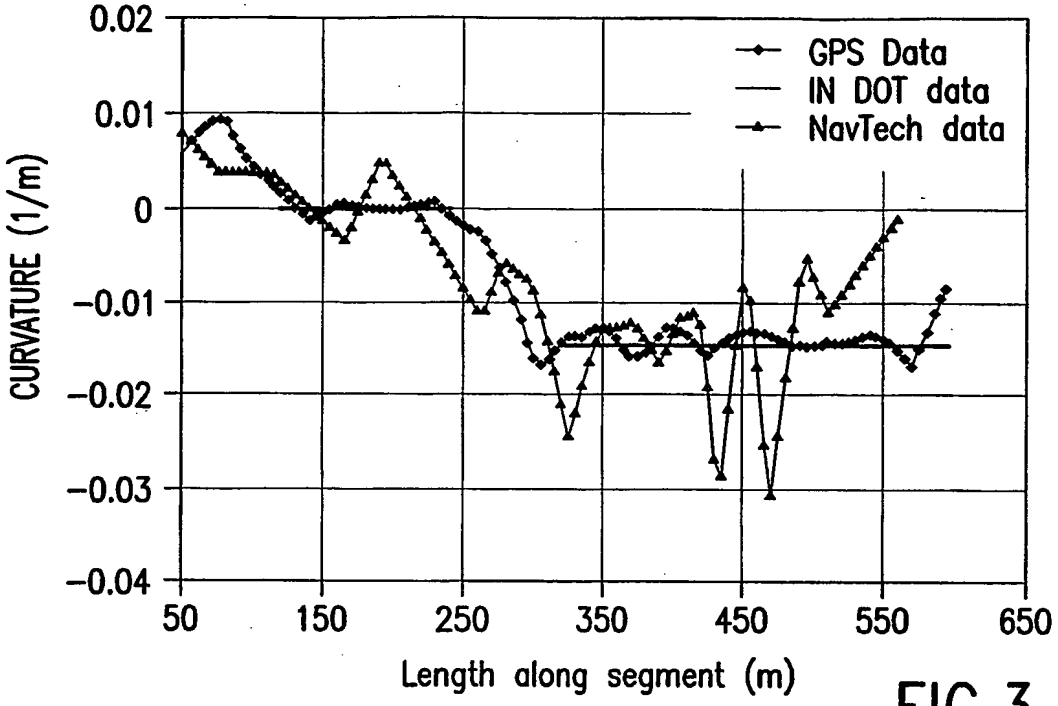

0.02
0.01
0
−0.01
−0.02
−0.03
−0.04
CURVATURE (1/m)
50
150
250
350
450
550
650
Length along segment (m)
GPS Data
IN DOT data
NavTech data

FIG.3

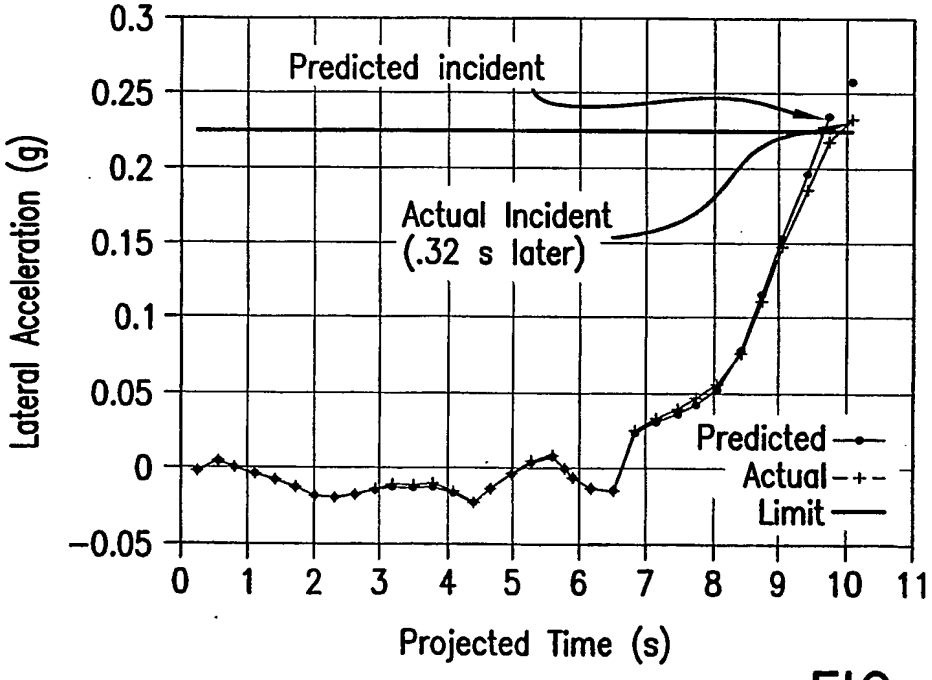

0.3
0.25
0.2
0.15
0.1
0.05
0
−0.05
Lateral Acceleration (g)
0
1
2
3
4
5
6
7
8
9
10
11
Projected Time (s)
Predicted incident
Actual Incident
(.32 s later)
Predicted
Actual
Limit

FIG.4

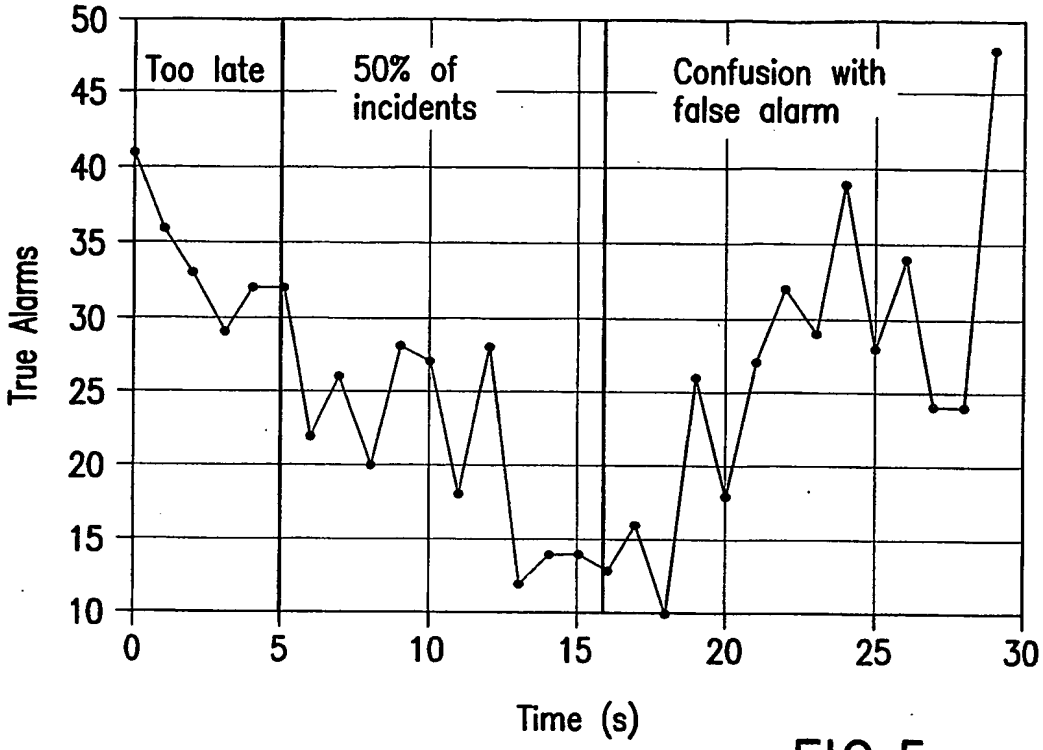

Too late
50% of incidents
Confusion with false alarm
True Alarms
Time (s)
50
45
40
35
30
25
20
15
10
0
5
10
15
20
25
30

FIG.5

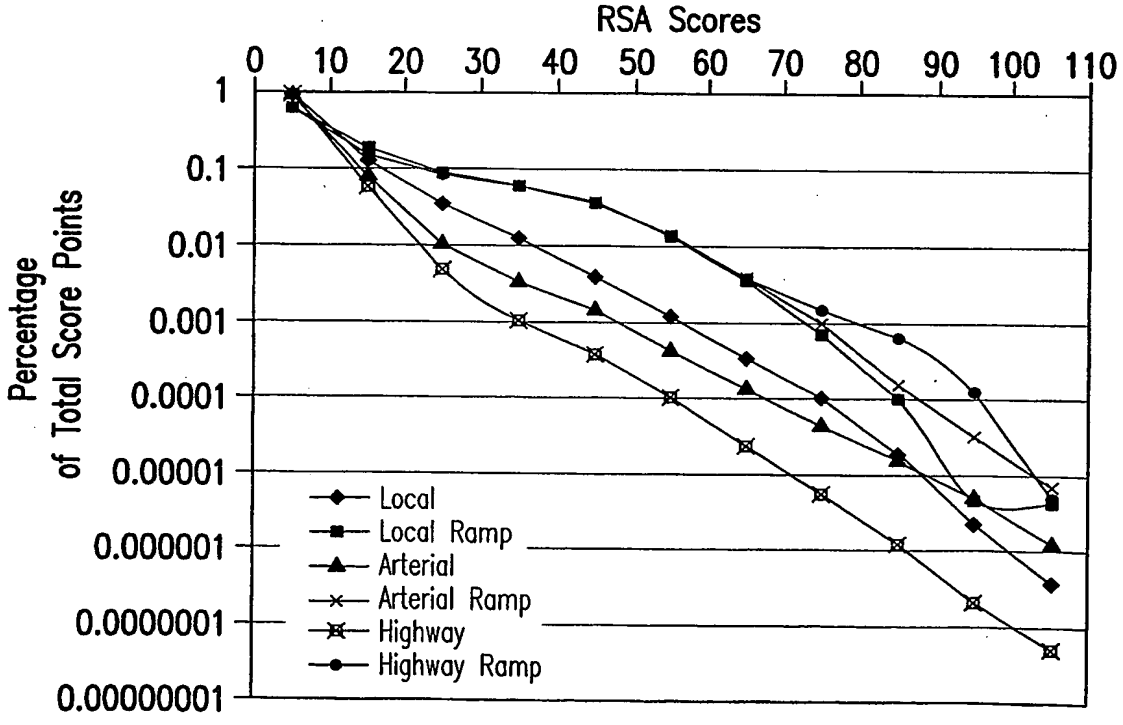

RSA Scores
0 10 20 30 40 50 60 70 80 90 100 110
Percentage of Total Score Points
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0.0000001
0.00000001
Local
Local Ramp
Arterial
Arterial Ramp
Highway
Highway Ramp

FIG.6

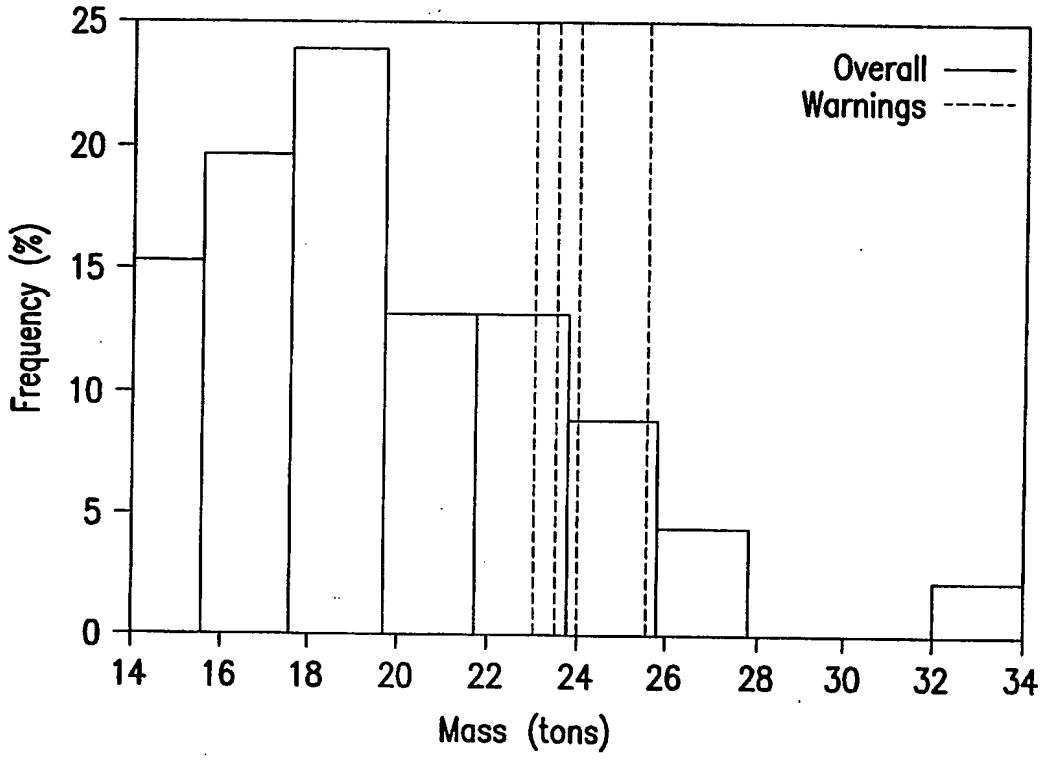
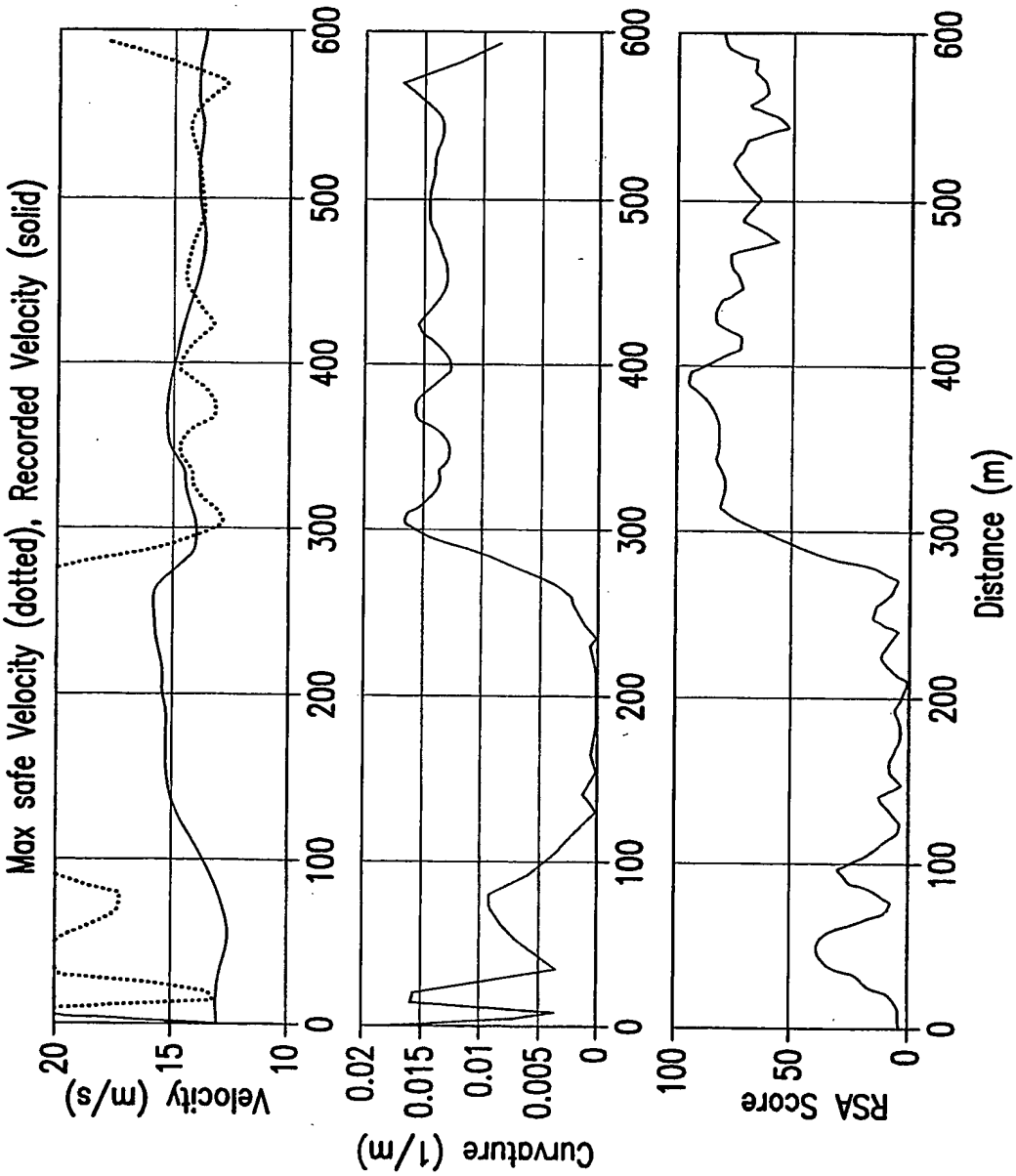

25
20
15
10
5
0
Frequency (%)
14
16
18
20
22
24
26
28
30
32
34
Mass (tons)
Overall
Warnings

FIG.7

FIG.8


Max safe Velocity (dotted), Recorded Velocity (solid)
Velocity (m/s)
20
15
10
Curvature (1/m)
0.02
0.015
0.01
0.005
0
RSA Score
100
50
0
0
100
200
300
400
500
600
Distance (m)

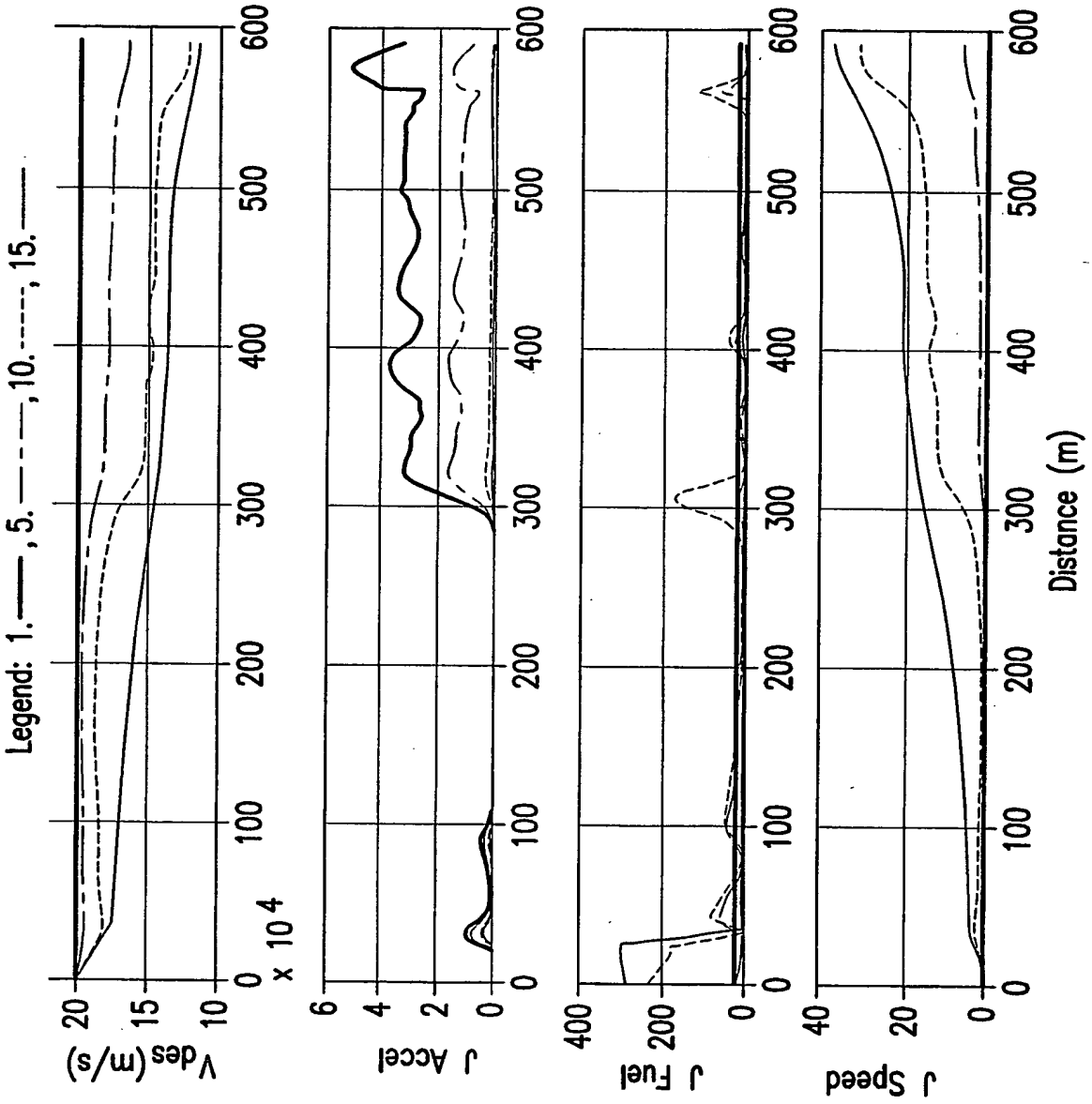


FIG.9

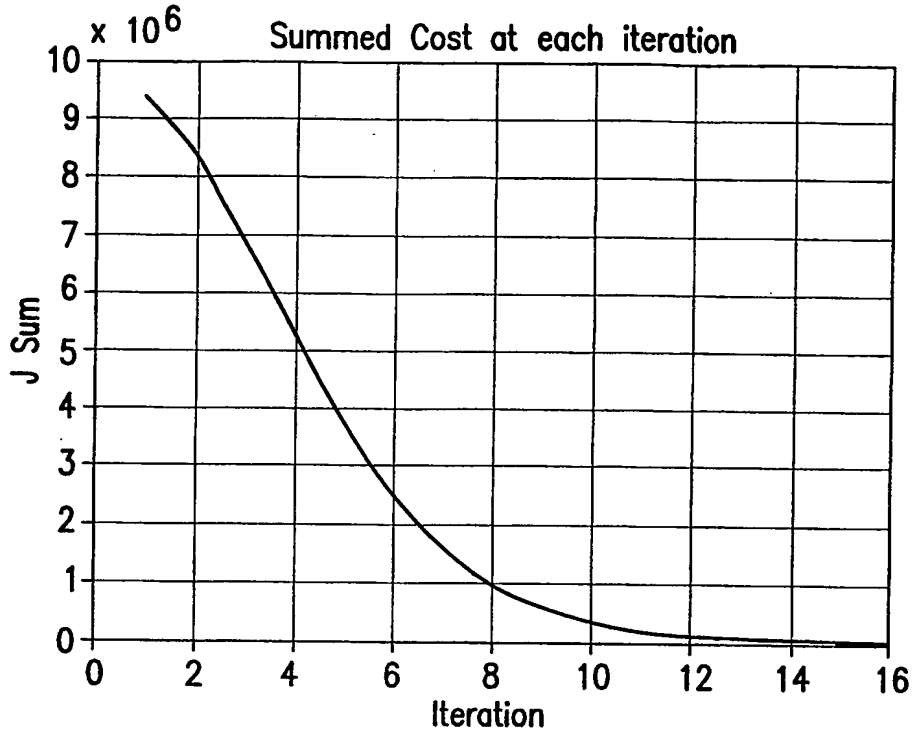

x 10^6
Summed Cost at each iteration
J Sum
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
8
10
12
14
16
Iteration

FIG.10

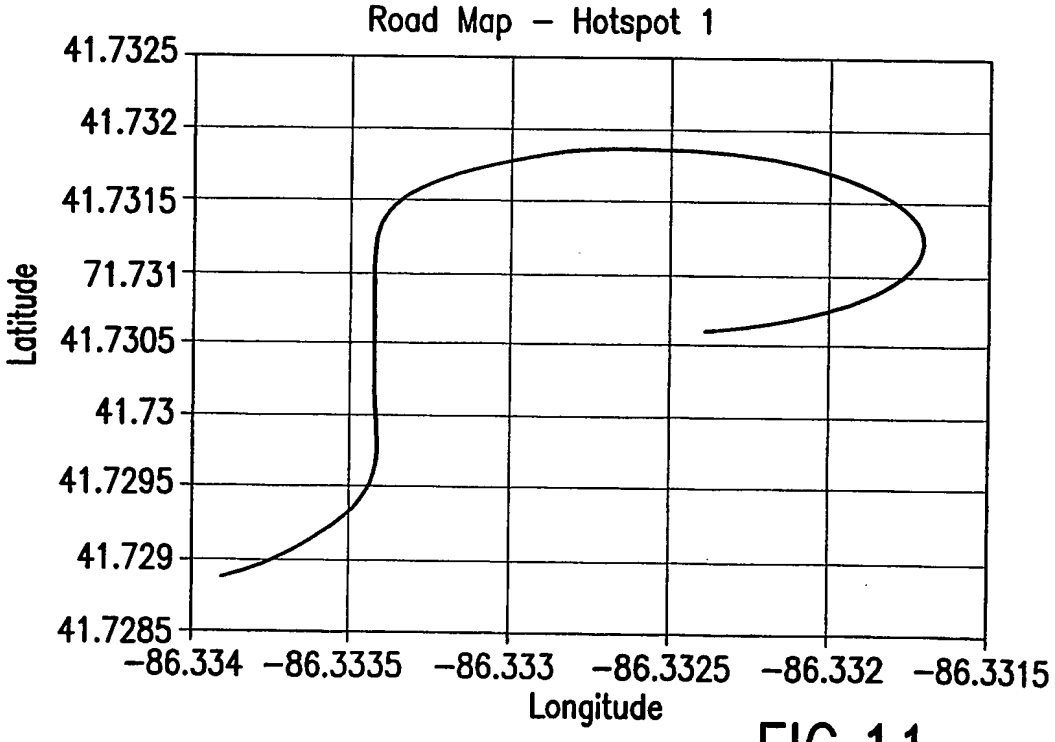

Road Map – Hotspot 1
Latitude
41.7325
41.732
41.7315
71.731
41.7305
41.73
41.7295
41.729
41.7285
-86.334
-86.3335
-86.333
-86.3325
-86.332
-86.3315
Longitude

FIG.11

FIG. 12

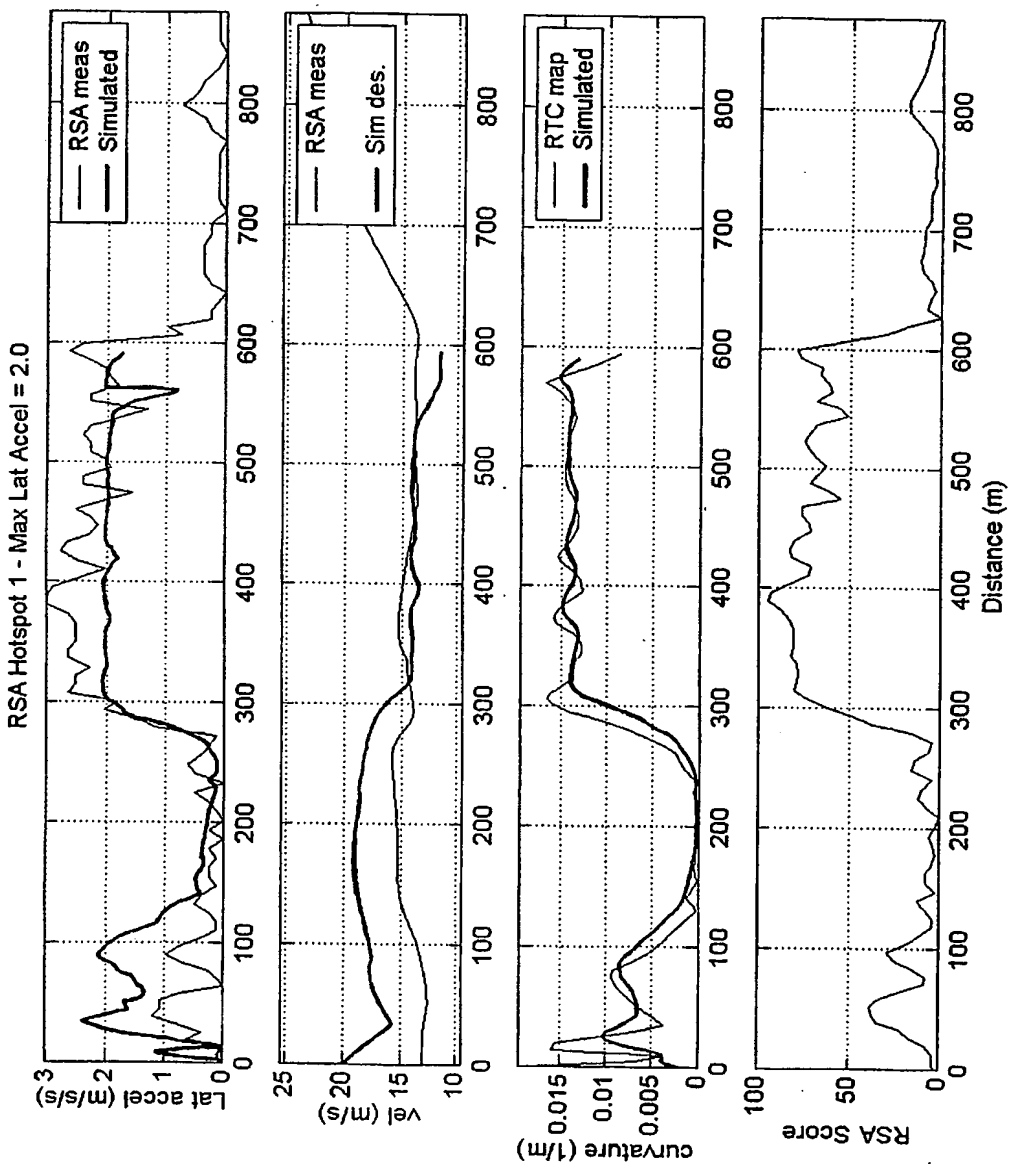

RSA Hotspot 1 - Max Lat Accel = 2.0
Lat accel (m/s/s)
RSA meas
Simulated
vel (m/s)
RSA meas
Sim des.
curvature (1/m)
RTC map
Simulated
RSA Score
Distance (m)

FIG. 13

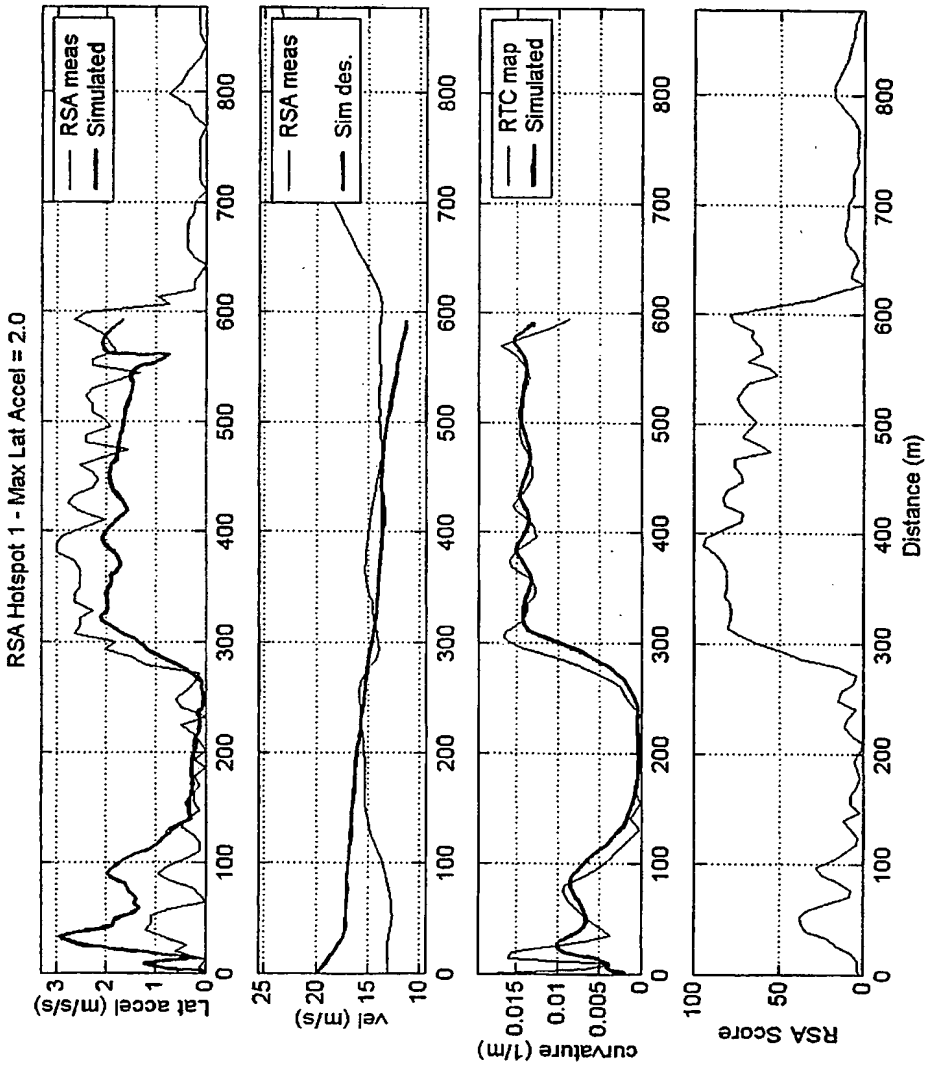
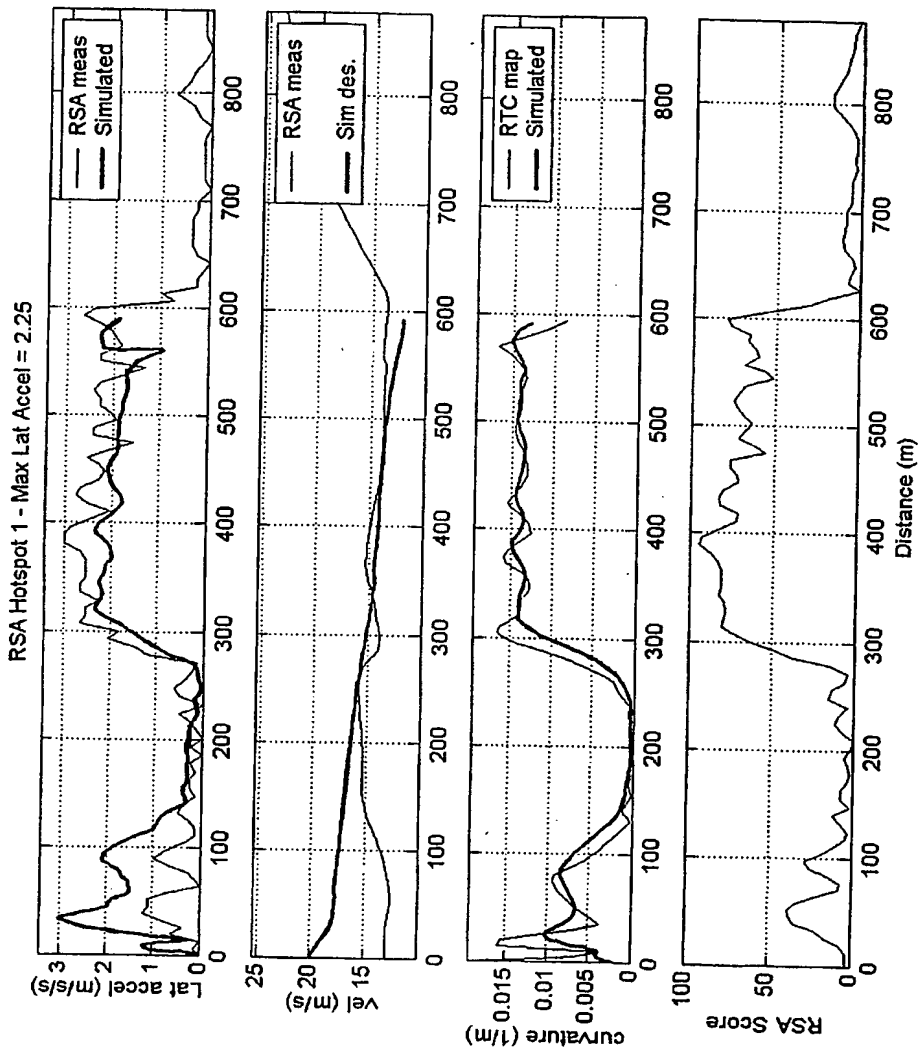

RSA Hotspot 1 - Max Lat Accel = 2.0
Lat accel (m/s/s)
RSA meas
Simulated
vel (m/s)
RSA meas
Sim des.
curvature (1/m)
RTC map
Simulated
RSA Score
Distance (m)

FIG. 14


RSA Hotspot 1 - Max Lat Accel = 2.25
Lat accel (m/s/s)
RSA meas
Simulated
Vel (m/s)
RSA meas
Sim des.
curvature (1/m)
RTC map
Simulated
RSA Score
Distance (m)

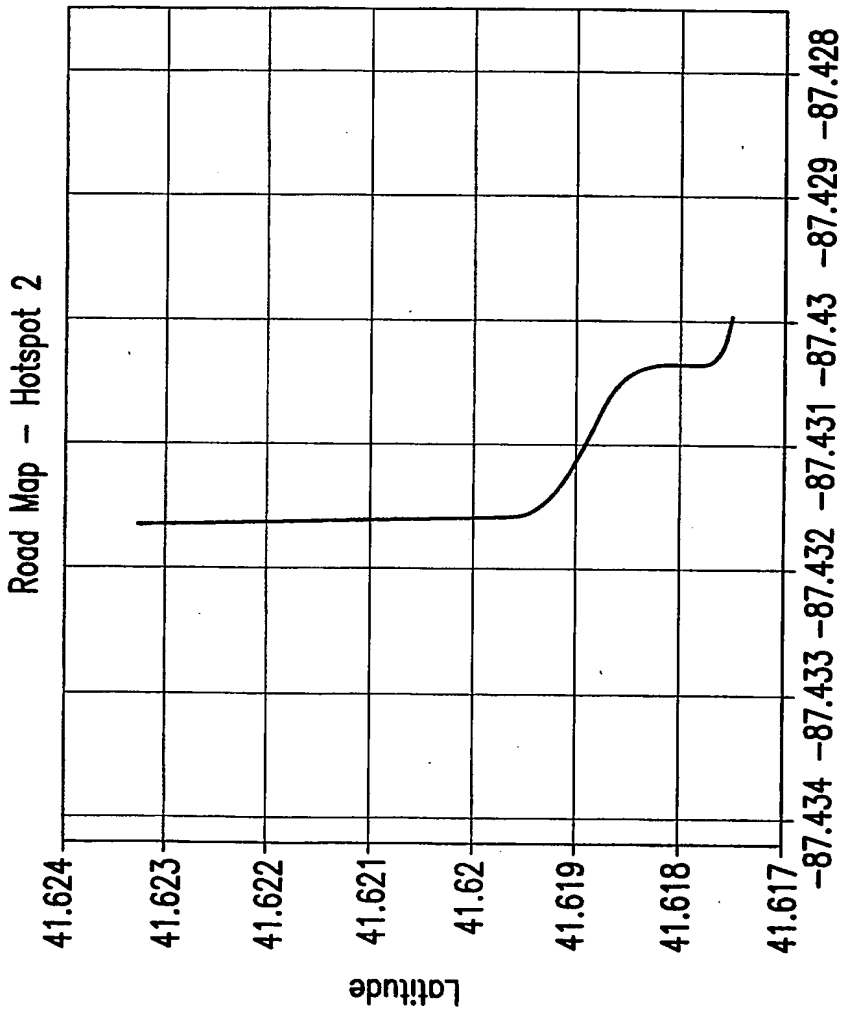
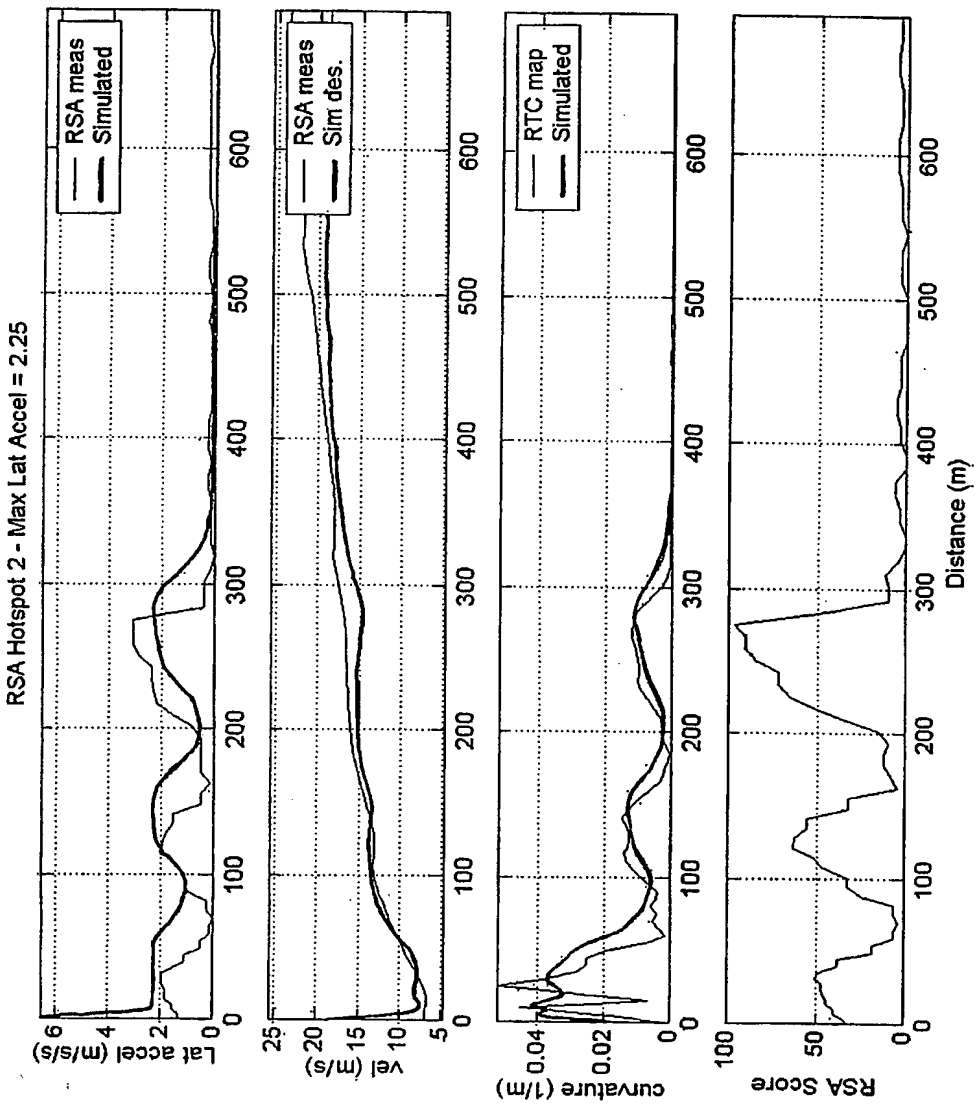

Road Map - Hotspot 2
Latitude
41.624
41.623
41.622
41.621
41.62
41.619
41.618
41.617
-87.434 -87.433 -87.432 -87.431 -87.43 -87.429 -87.428
Longitude

FIG.15

FIG. 16


RSA Hotspot 2 - Max Lat Accel = 2.25
Lat accel (m/s/s)
RSA meas
Simulated
vel (m/s)
RSA meas
Sim des.
curvature (1/m)
RTC map
Simulated
RSA Score
Distance (m)

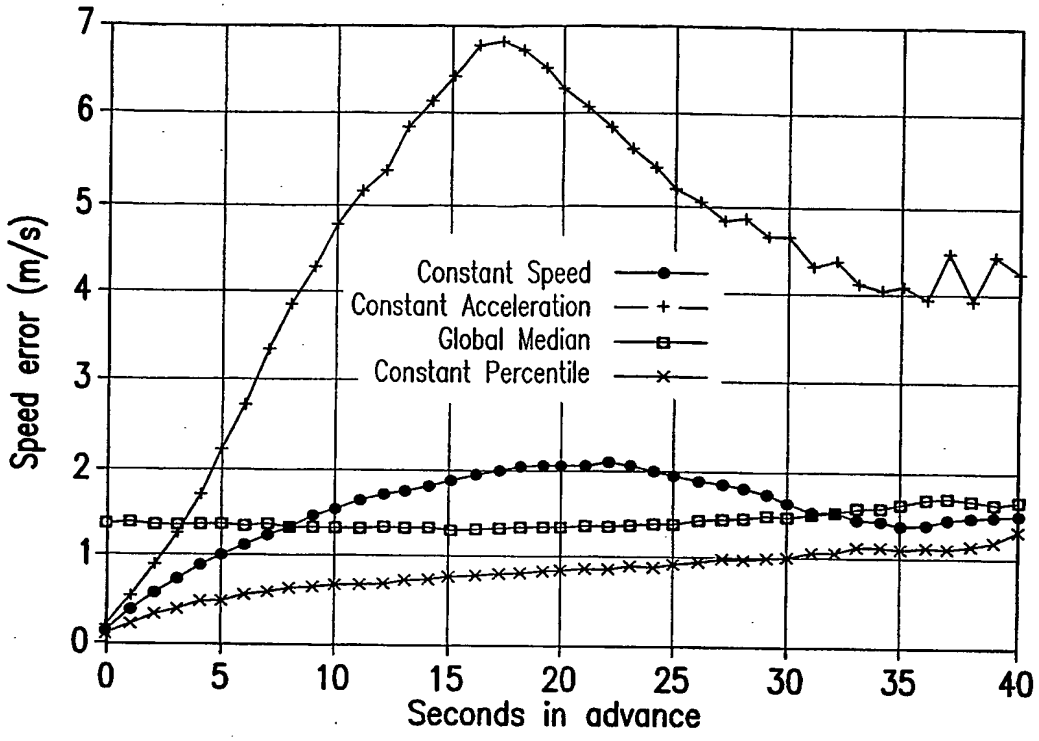

Speed error (m/s)
Seconds in advance
Constant Speed
Constant Acceleration
Global Median
Constant Percentile
0
1
2
3
4
5
6
7
0
5
10
15
20
25
30
35
40

FIG.17

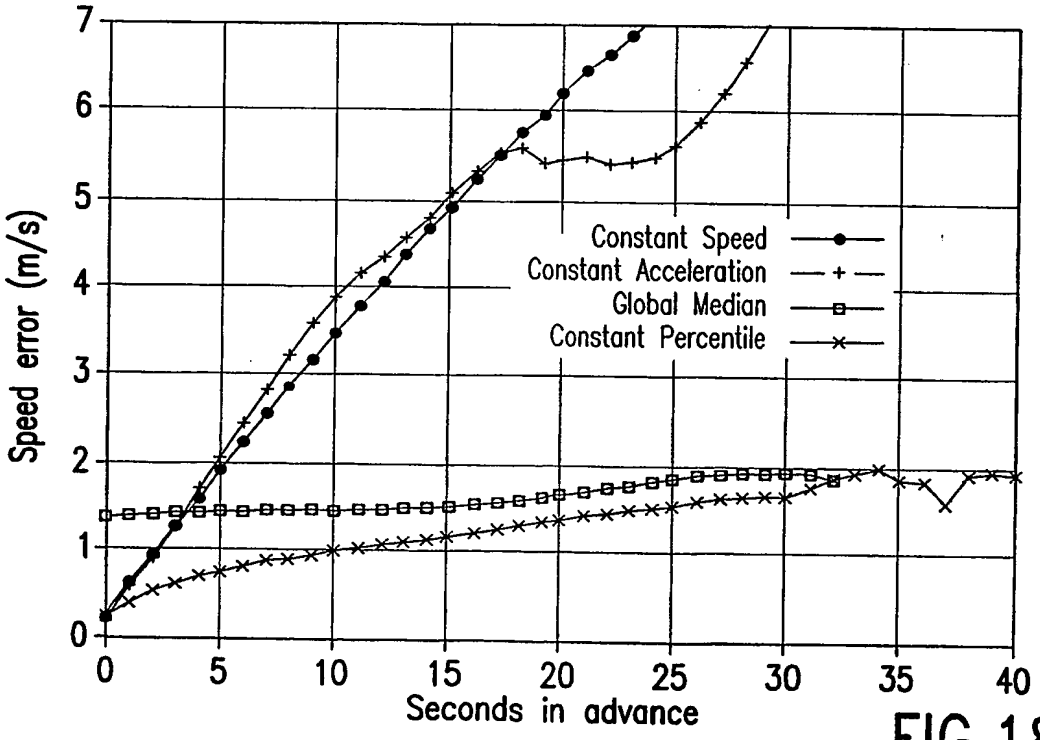

Speed error (m/s)
Seconds in advance
Constant Speed
Constant Acceleration
Global Median
Constant Percentile
0
1
2
3
4
5
6
7
0
5
10
15
20
25
30
35
40

FIG.18

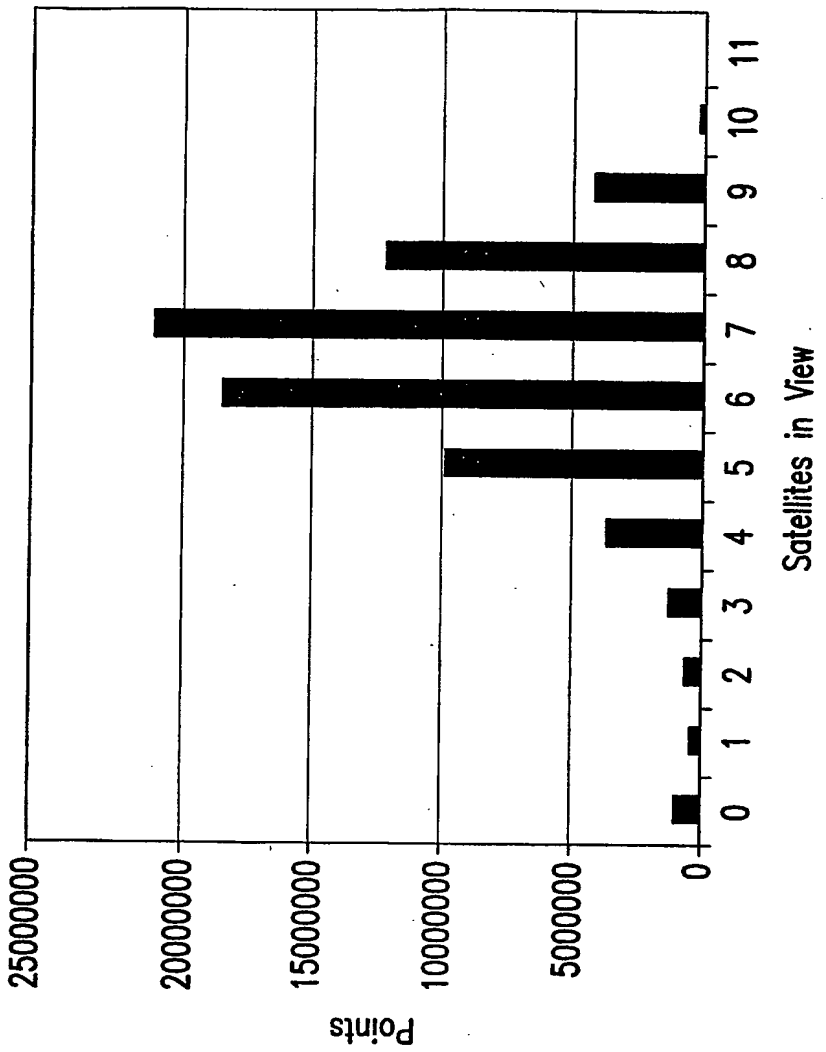

25000000
20000000
15000000
10000000
5000000
0
Points
0 1 2 3 4 5 6 7 8 9 10 11
Satellites in View

FIG.19

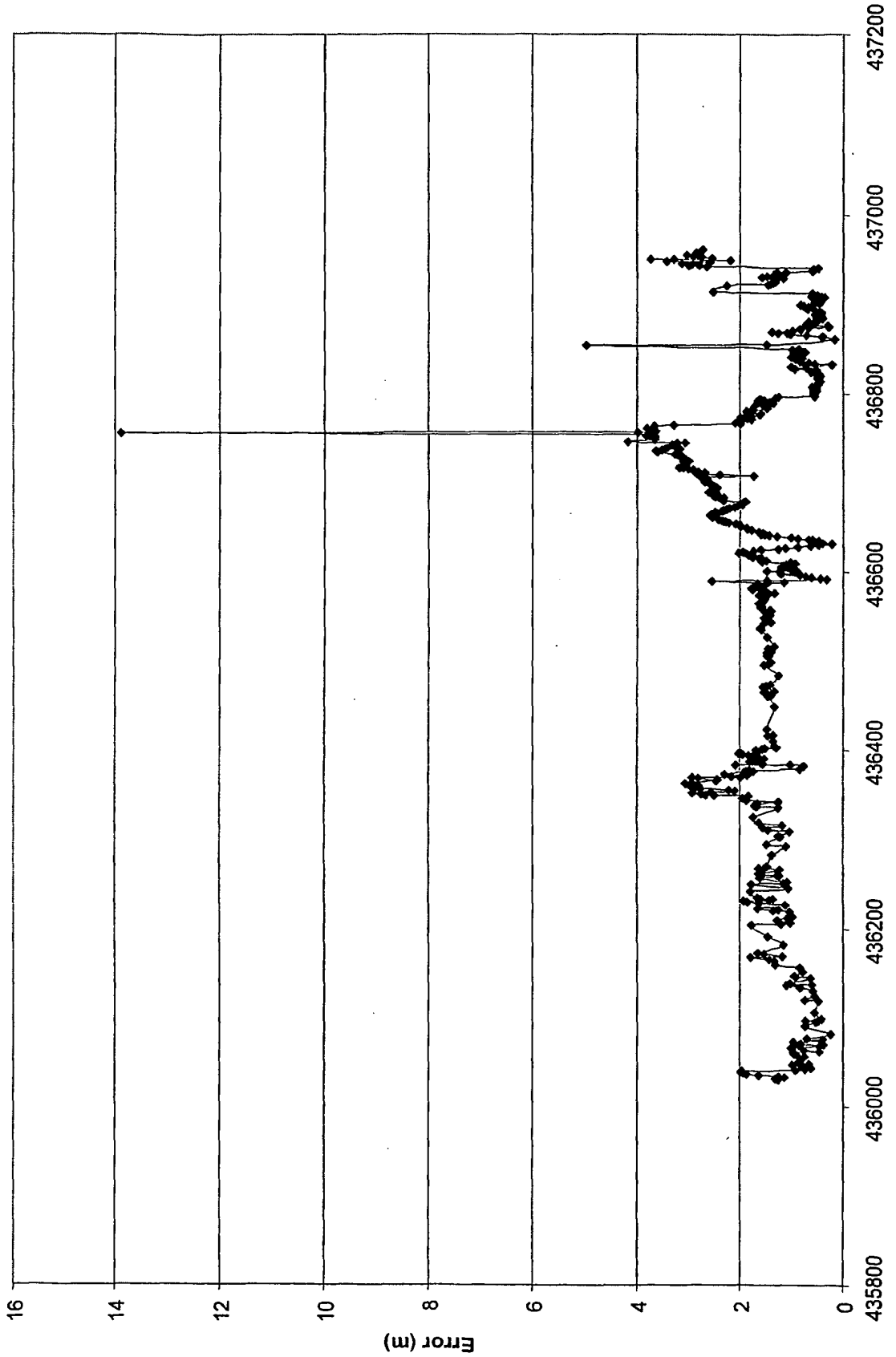

Error (m)
0
2
4
6
8
10
12
14
16
435800
436000
436200
436400
436600
436800
437000
437200
Time (s)

FIG.20

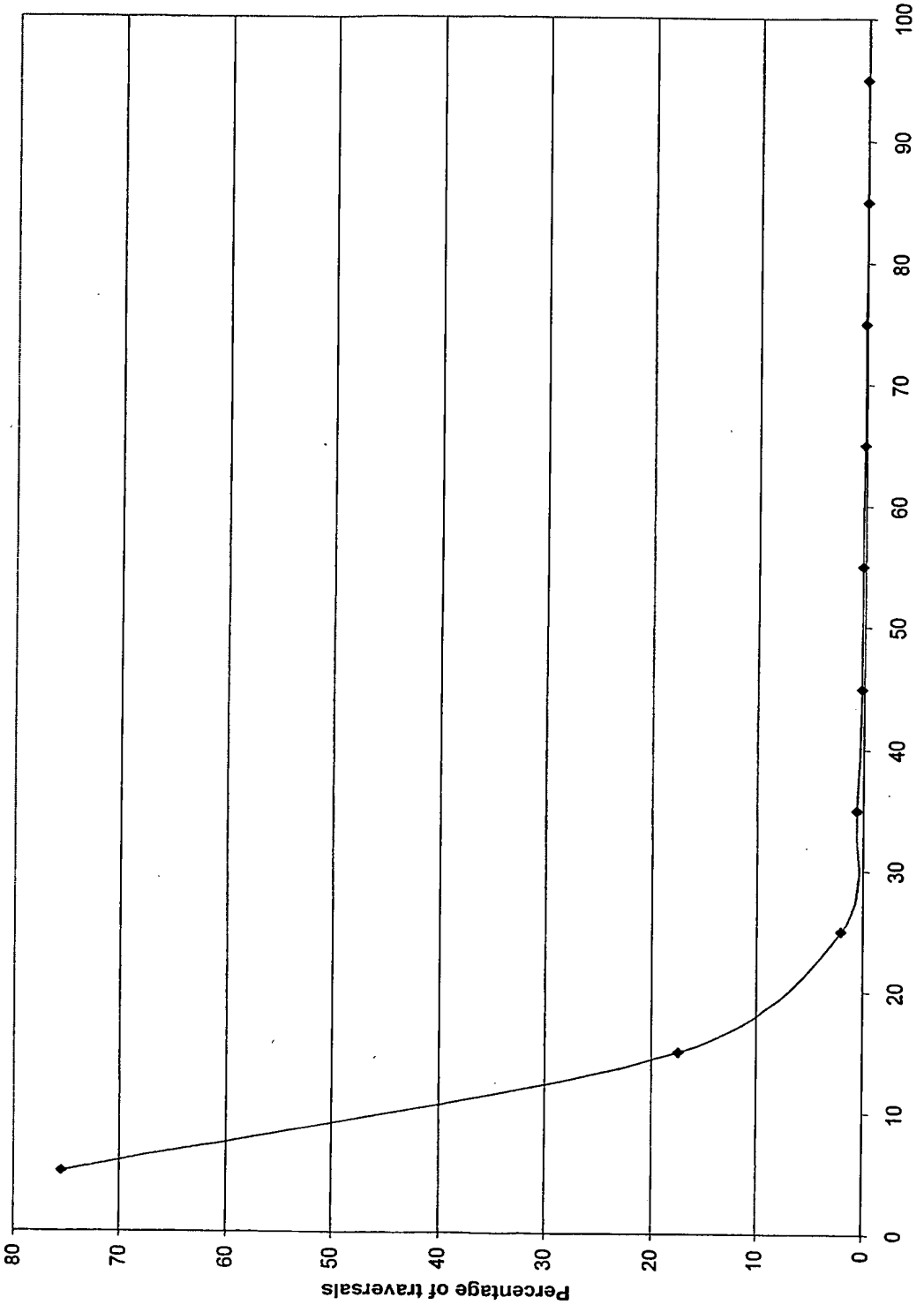

Percentage of traversals
0
10
20
30
40
50
60
70
80
Map match error (m)
0
10
20
30
40
50
60
70
80
90
100

FIG.21

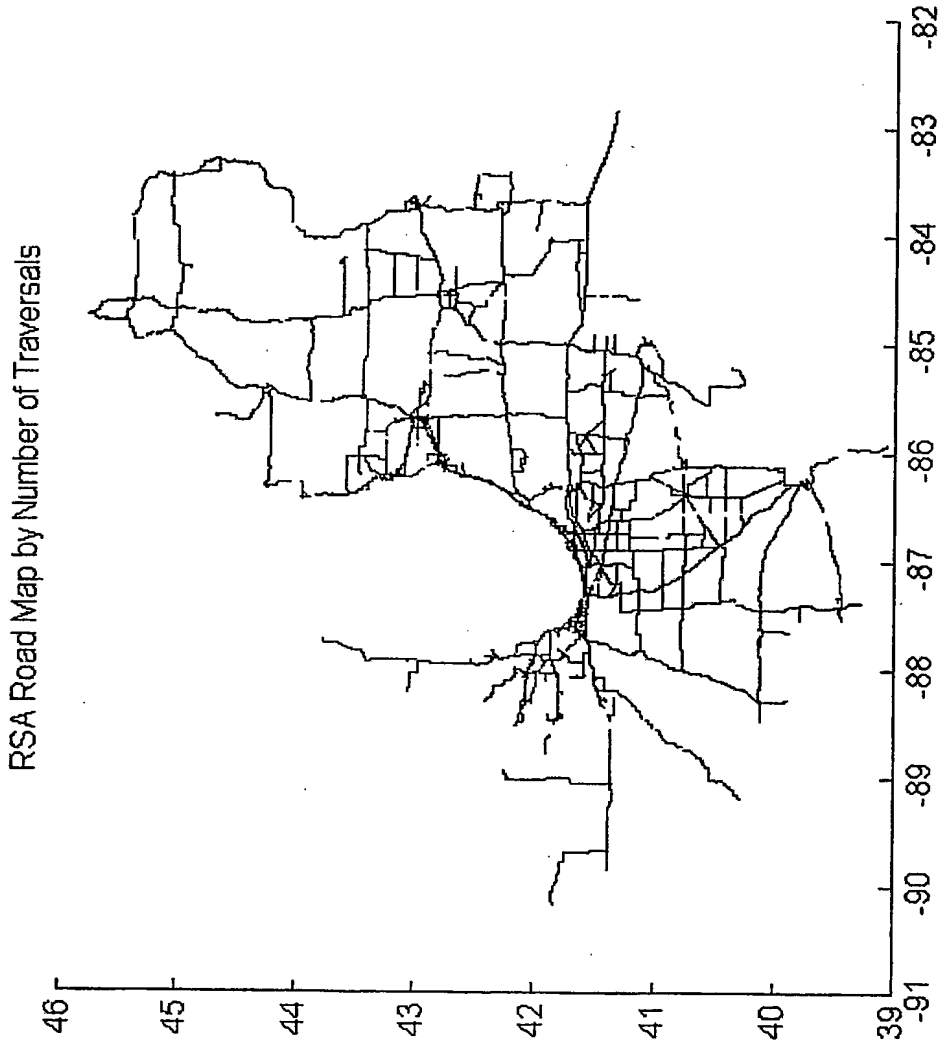

RSA Road Map by Number of Traversals
46
45
44
43
42
41
40
39
-91
-90
-89
-88
-87
-86
-85
-84
-83
-82

FIG.22

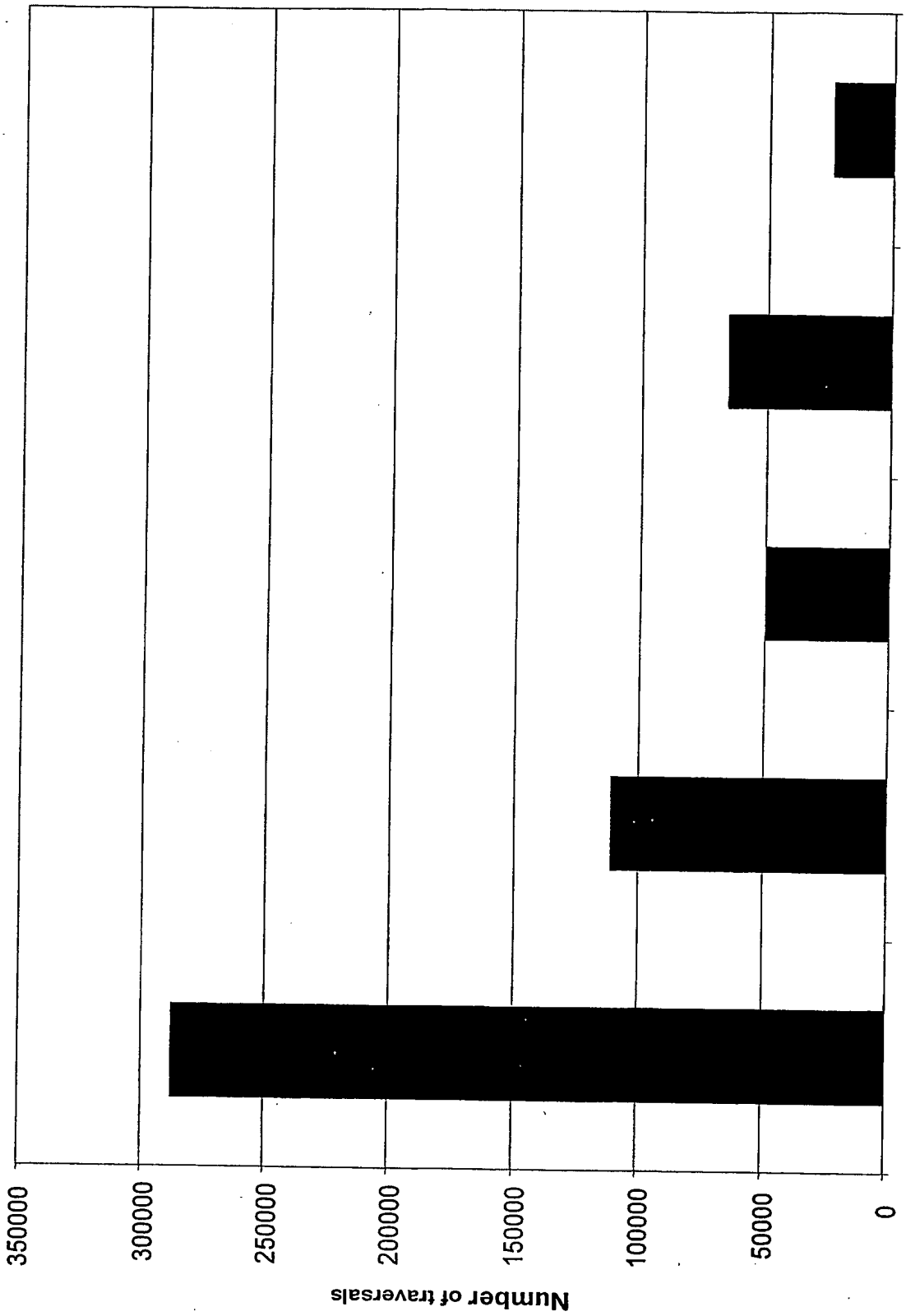

Number of traversals
350000
300000
250000
200000
150000
100000
50000
0
interstate
highway
Major road
Local road
ramps
Road category

FIG.23

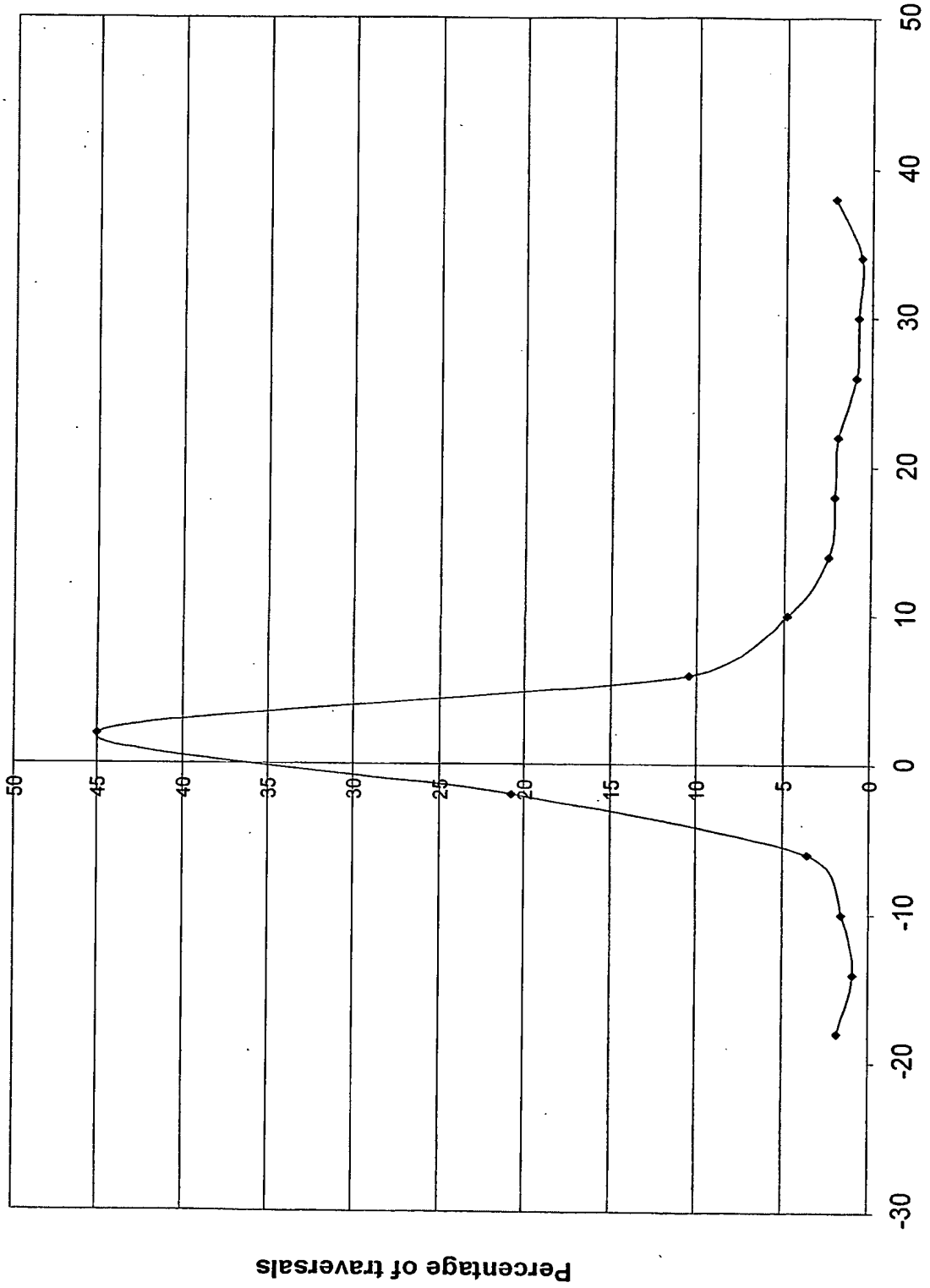

Percentage of traversals
50
45
40
35
30
25
20
15
10
5
0
-30
-20
-10
0
10
20
30
40
50
NavTech Time Underestimate (s)

FIG.24

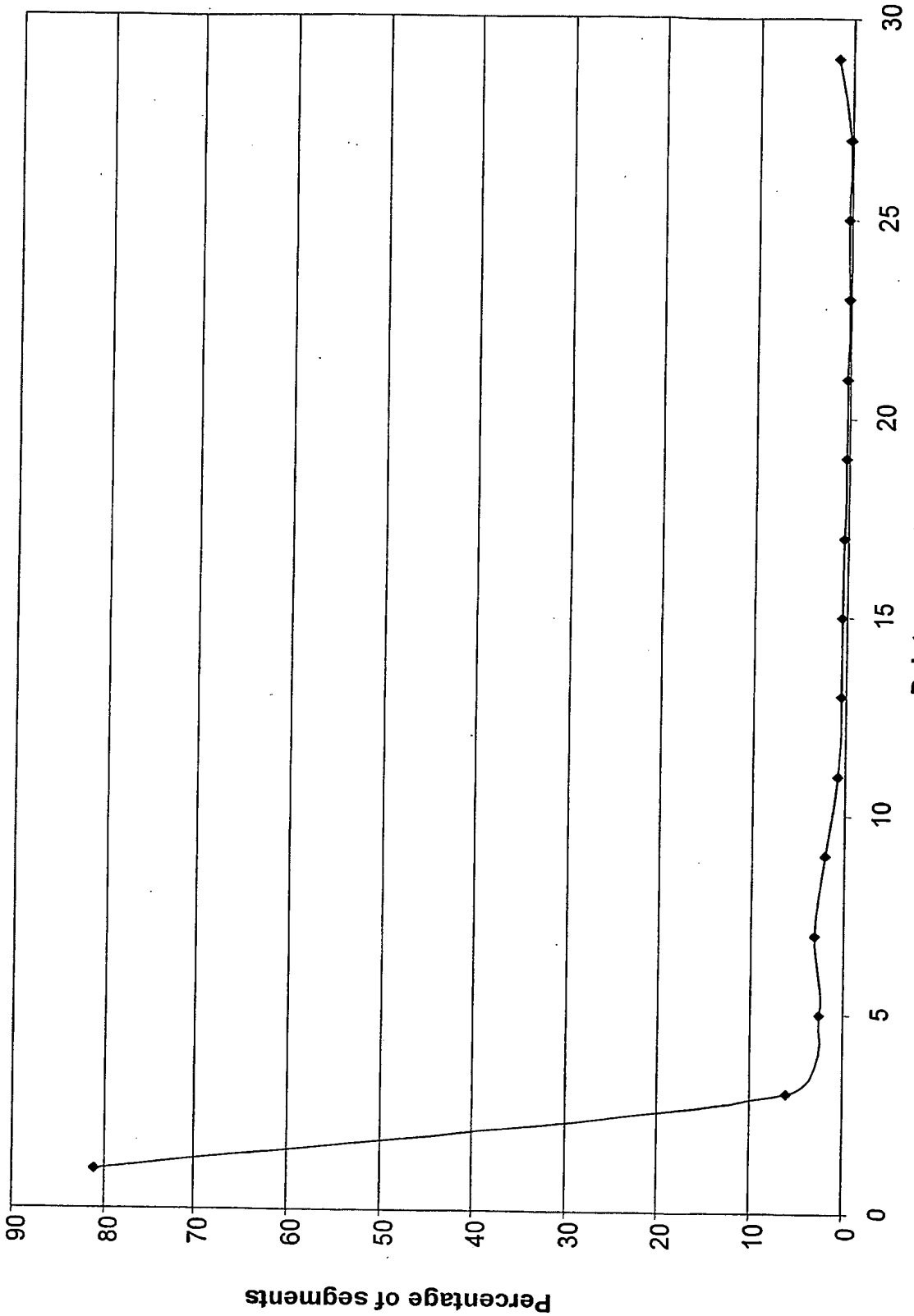

Percentage of segments
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Points per meter

FIG.25

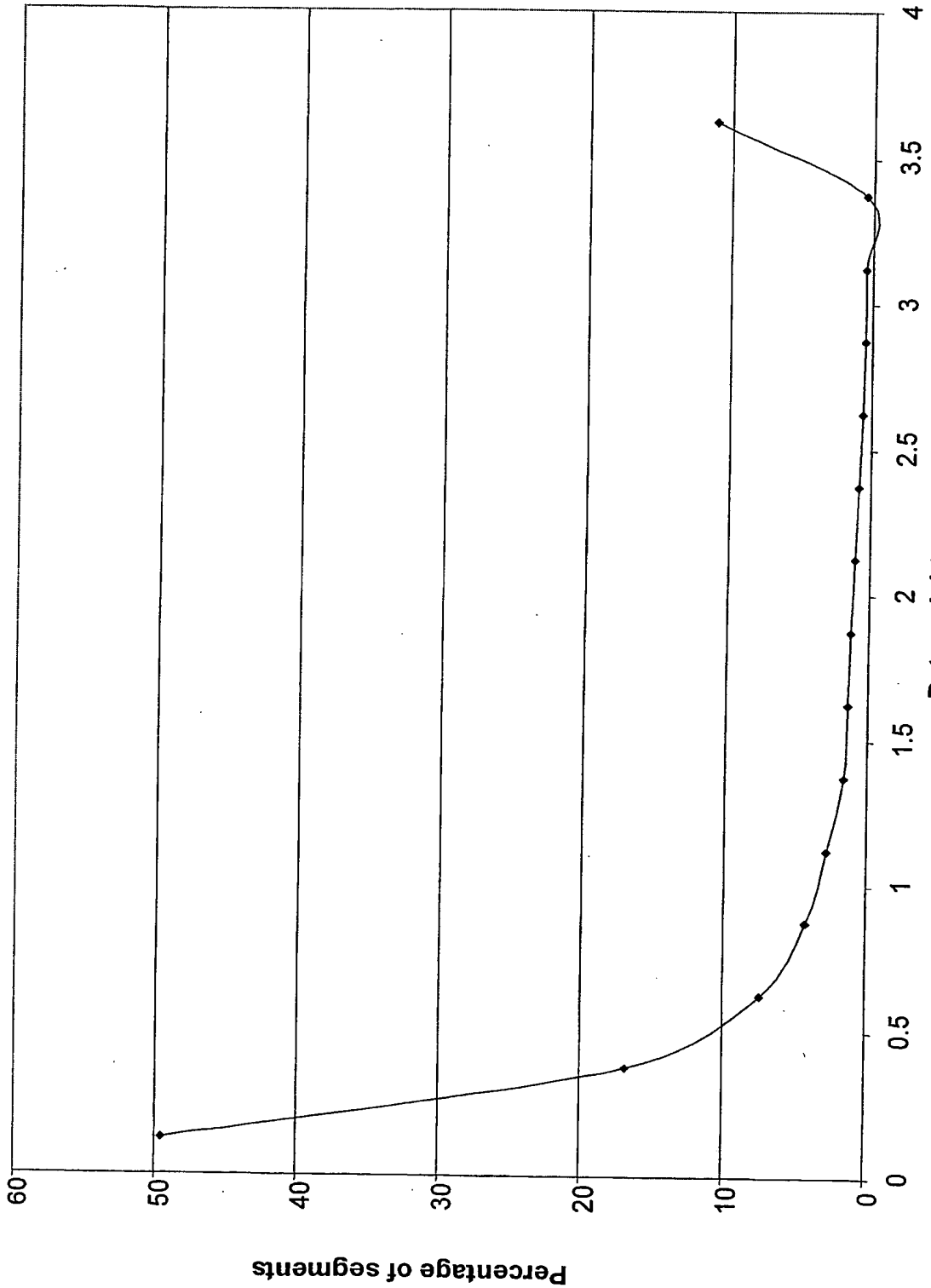

Percentage of segments
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
3
3.5
4
Data weight per meter

FIG.26

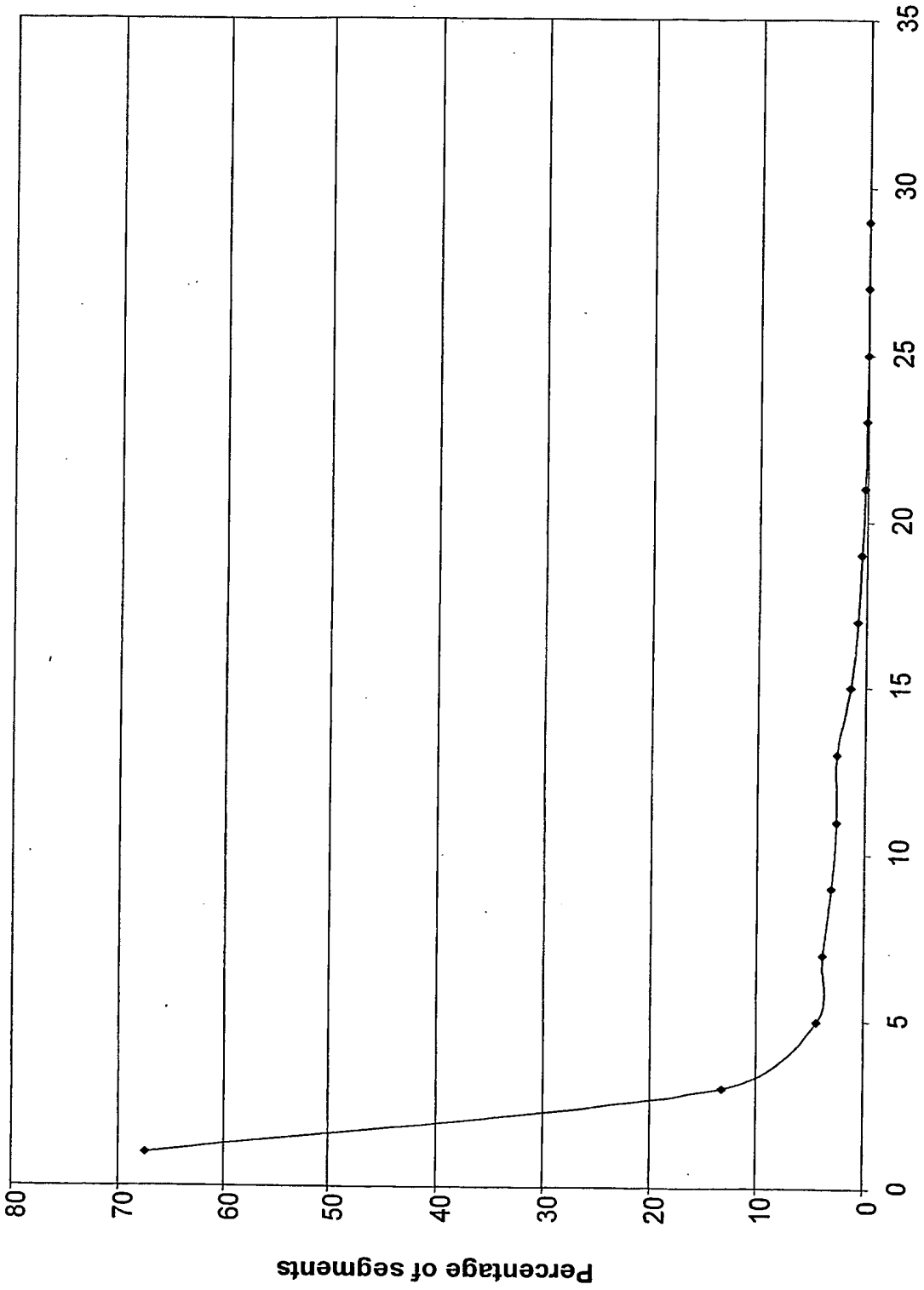

Percentage of segments
0
10
20
30
40
50
60
70
80
0
5
10
15
20
25
30
35
Road standard deviation (m)

FIG.27

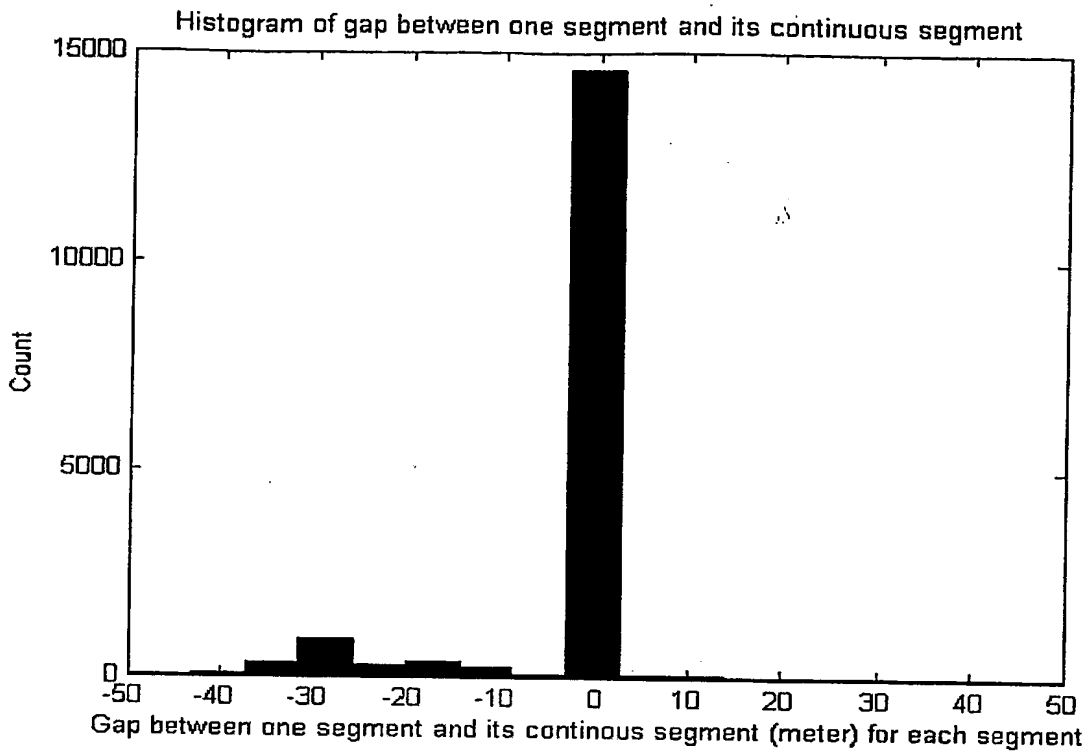

Histogram of gap between one segment and its continuous segment
15000
10000
5000
0
Count
-50
-40
-30
-20
-10
0
10
20
30
40
50
Gap between one segment and its continous segment (meter) for each segment

FIG.28

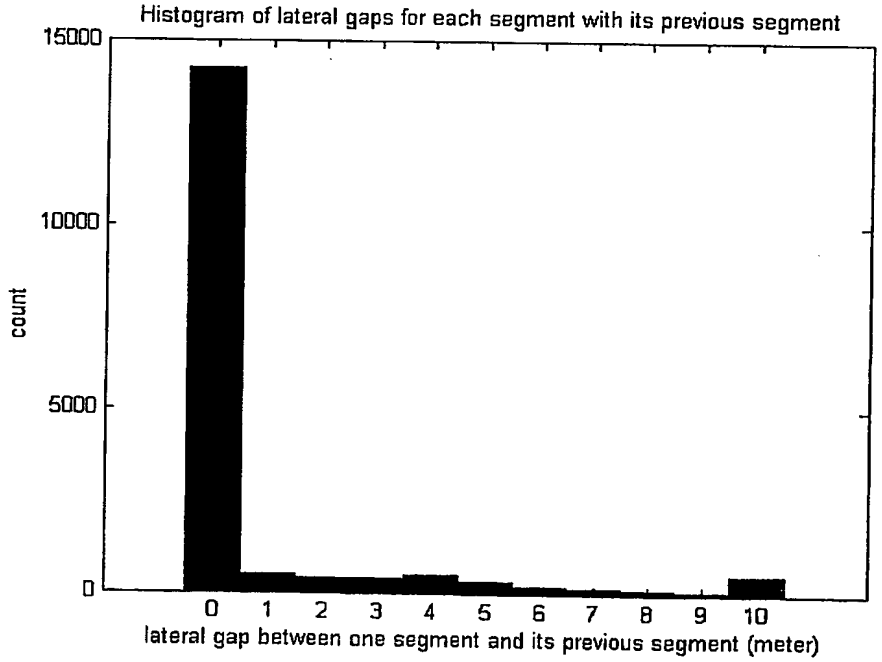

Histogram of lateral gaps for each segment with its previous segment
15000
10000
5000
0
count
0
1
2
3
4
5
6
7
8
9
10
lateral gap between one segment and its previous segment (meter)

FIG.29

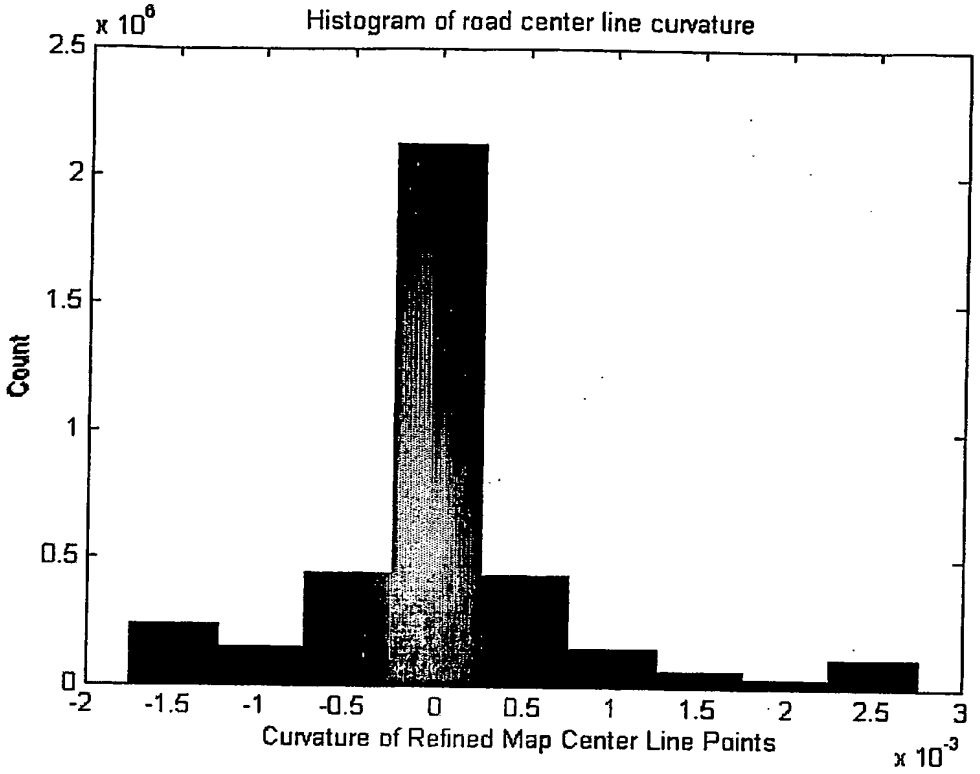

Histogram of road center line curvature
x 10^6
2.5
2
1.5
1
0.5
0
Count
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
Curvature of Refined Map Center Line Points
x 10^-3

FIG.30

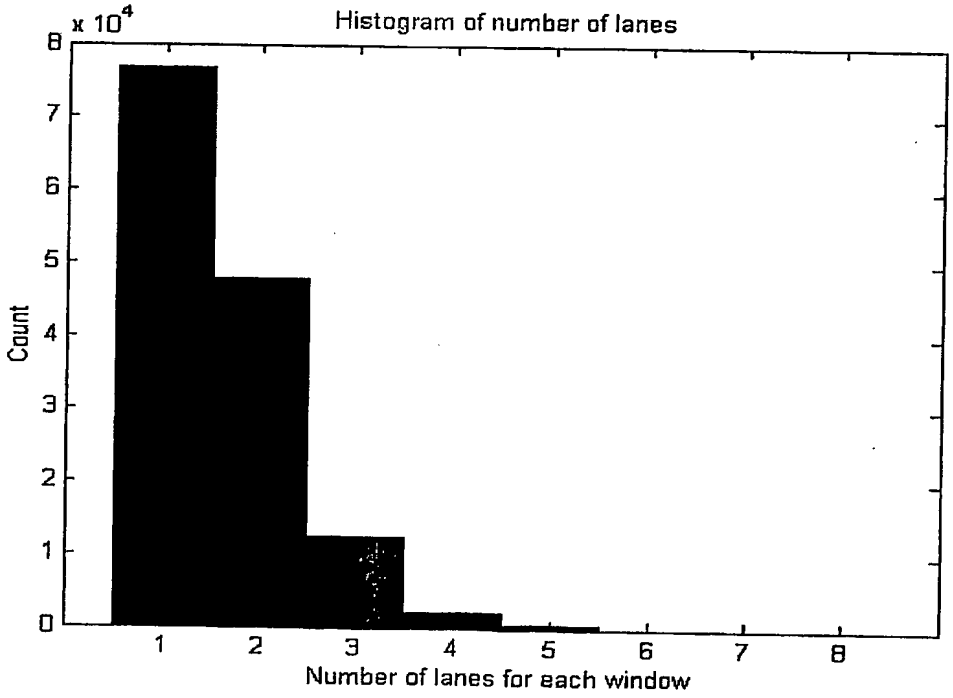

Histogram of number of lanes
x 10^4
8
7
6
5
4
3
2
1
0
Count
1
2
3
4
5
6
7
8
Number of lanes for each window

FIG.31

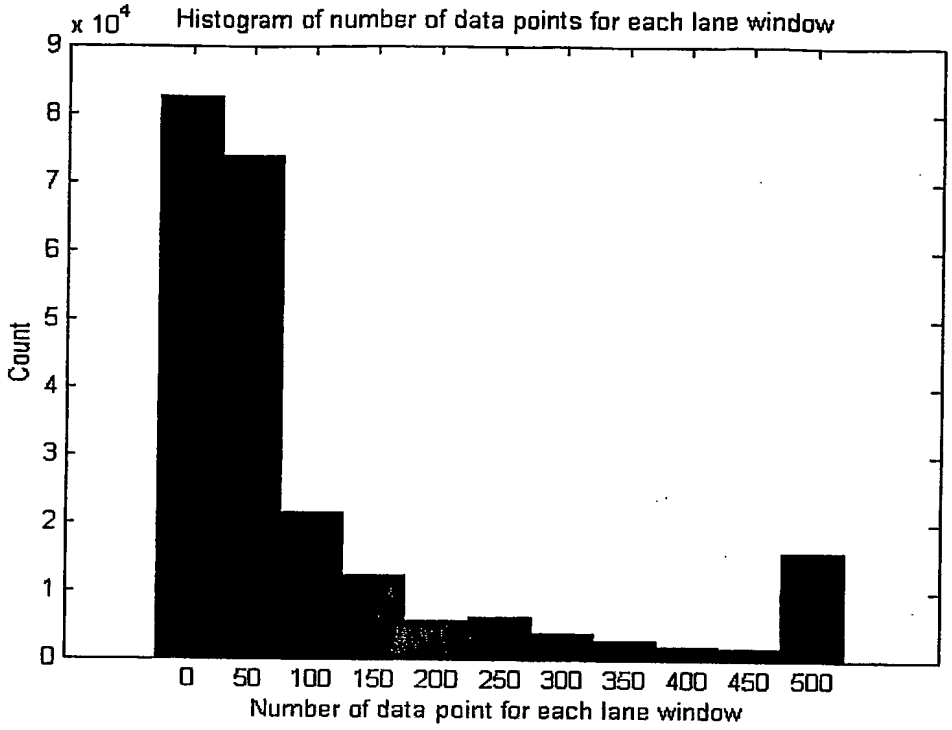

x 10^4
Histogram of number of data points for each lane window
Count
0
1
2
3
4
5
6
7
8
9
0 50 100 150 200 250 300 350 400 450 500
Number of data point for each lane window

FIG.32

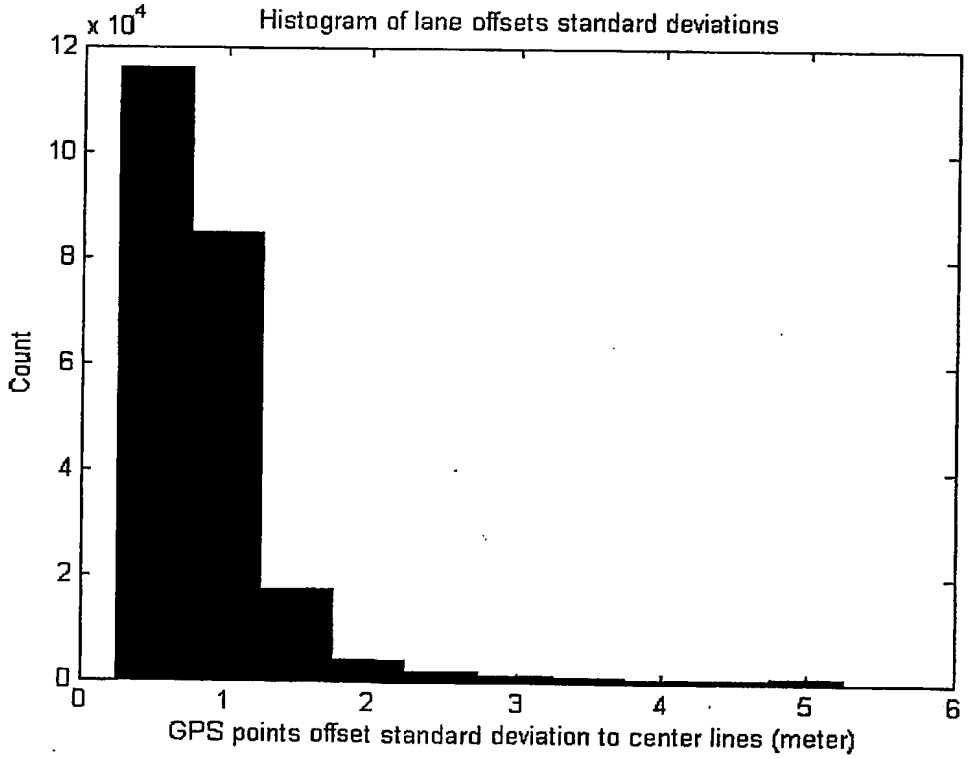

x 10^4
Histogram of lane offsets standard deviations
Count
0
2
4
6
8
10
12
0 1 2 3 4 5 6
GPS points offset standard deviation to center lines (meter)

FIG.33

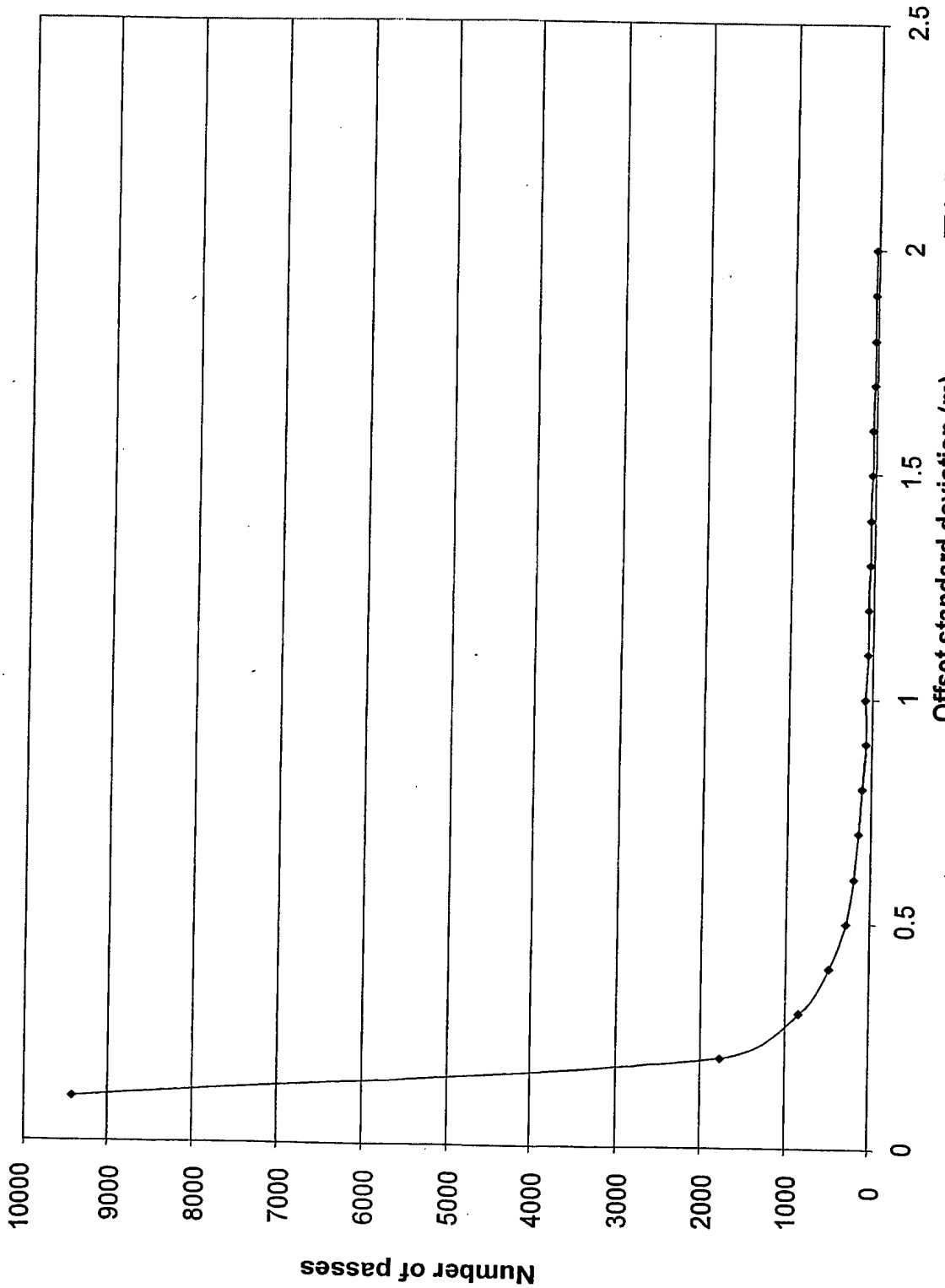

Number of passes
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
0.5
1
1.5
2
2.5
Offset standard deviation (m)

FIG. 34

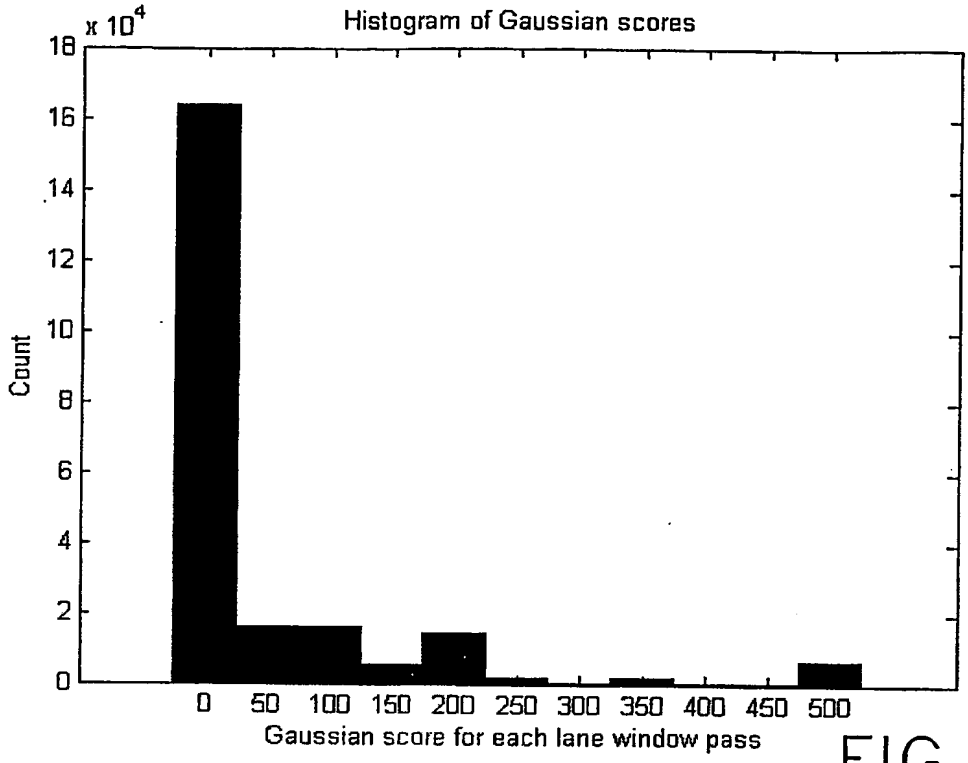

Histogram of Gaussian scores
x 10^4
18
16
14
12
10
8
6
4
2
0
Count
0 50 100 150 200 250 300 350 400 450 500
Gaussian score for each lane window pass

FIG.35

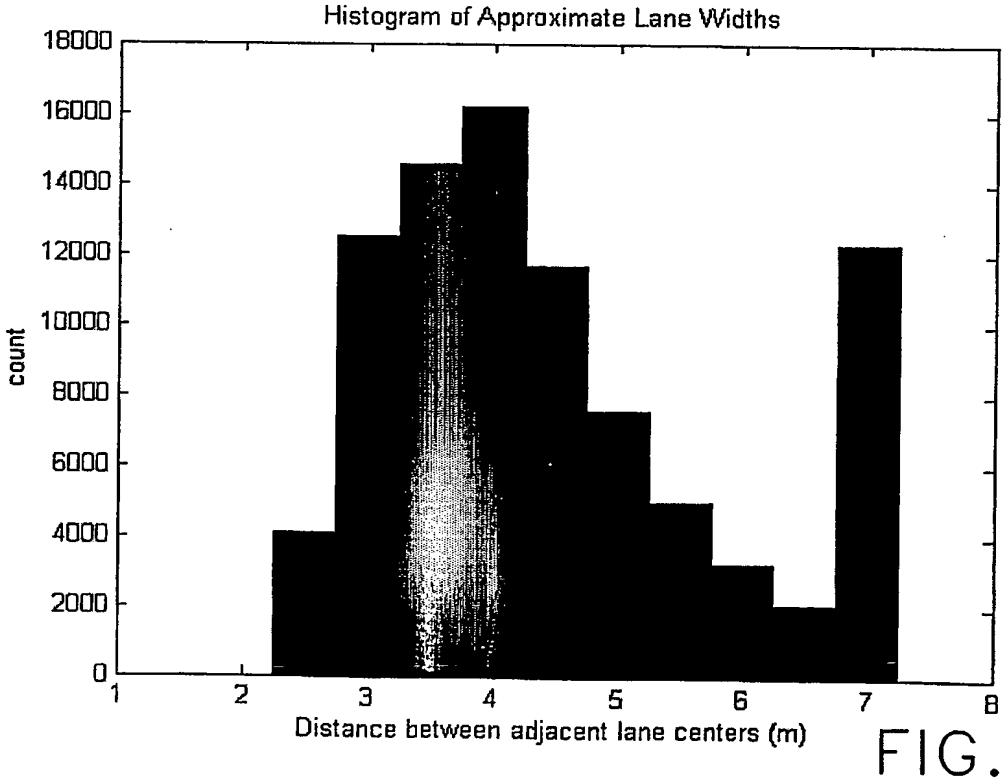

Histogram of Approximate Lane Widths
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
count
1 2 3 4 5 6 7 8
Distance between adjacent lane centers (m)

FIG.36

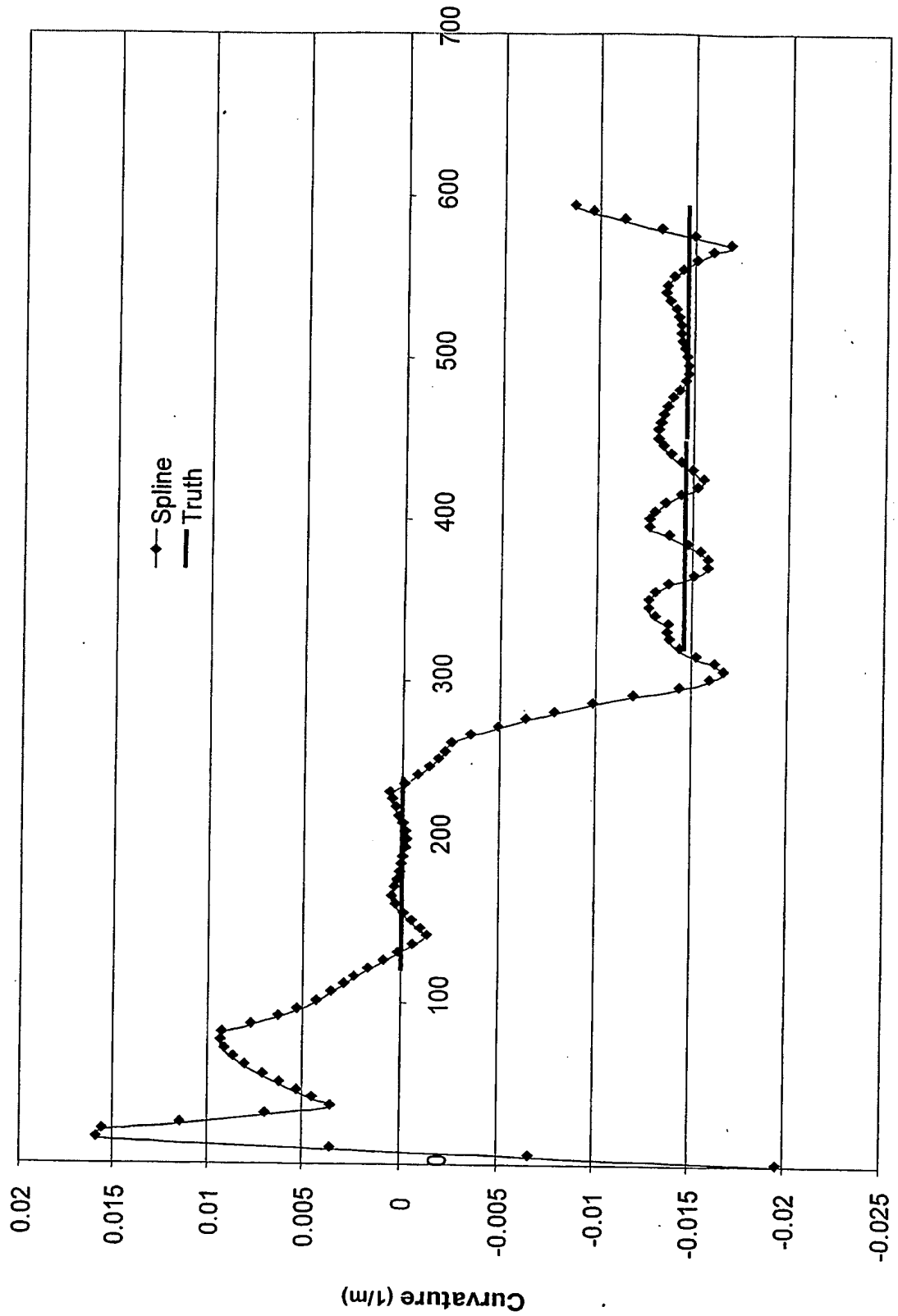

Curvature (1/m)
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
0
100
200
300
400
500
600
700
Length along Segment (m)
Spline
Truth

FIG. 37

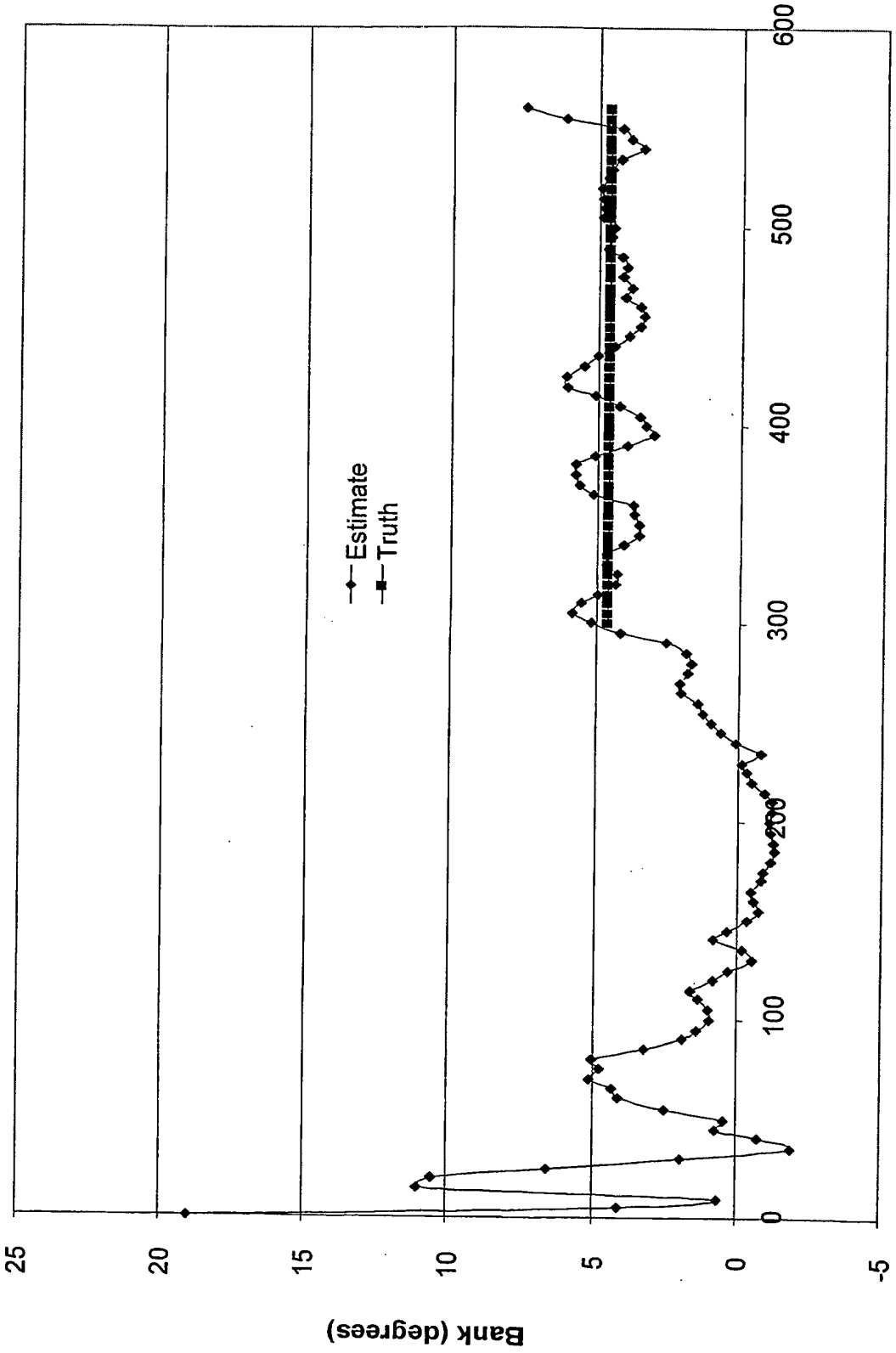

Bank (degrees)
25
20
15
10
5
0
-5
0
100
200
300
400
500
600
Length along Segment (m)
Estimate
Truth

FIG. 38

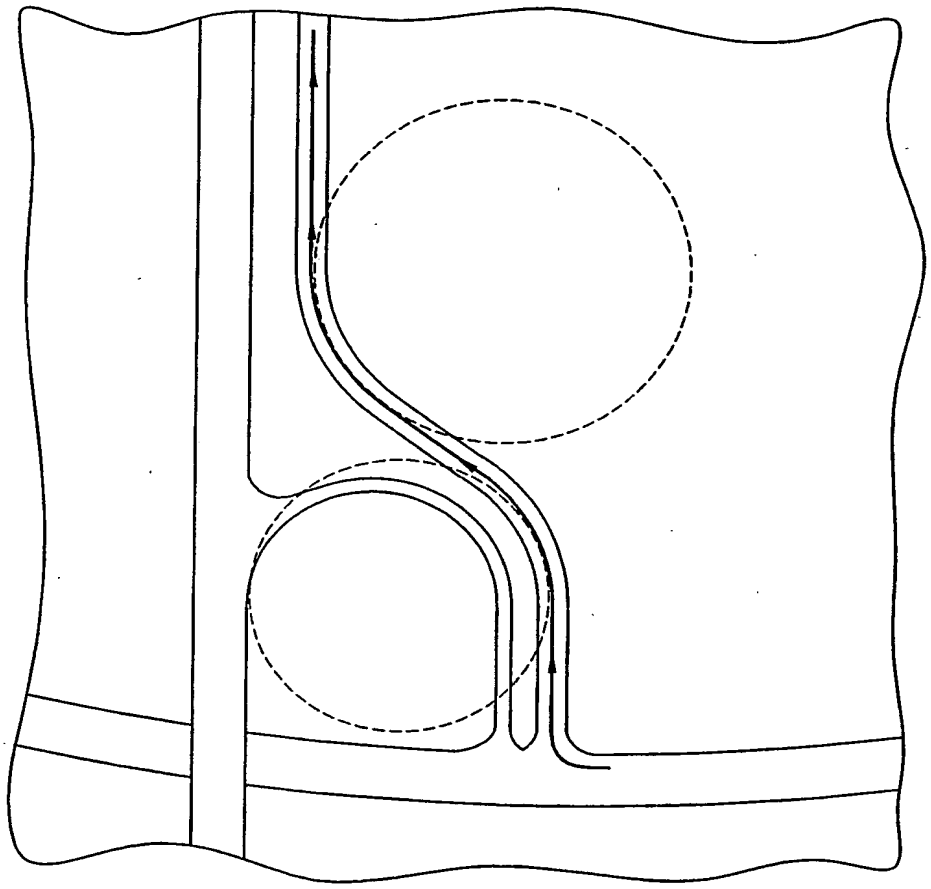


FIG.39

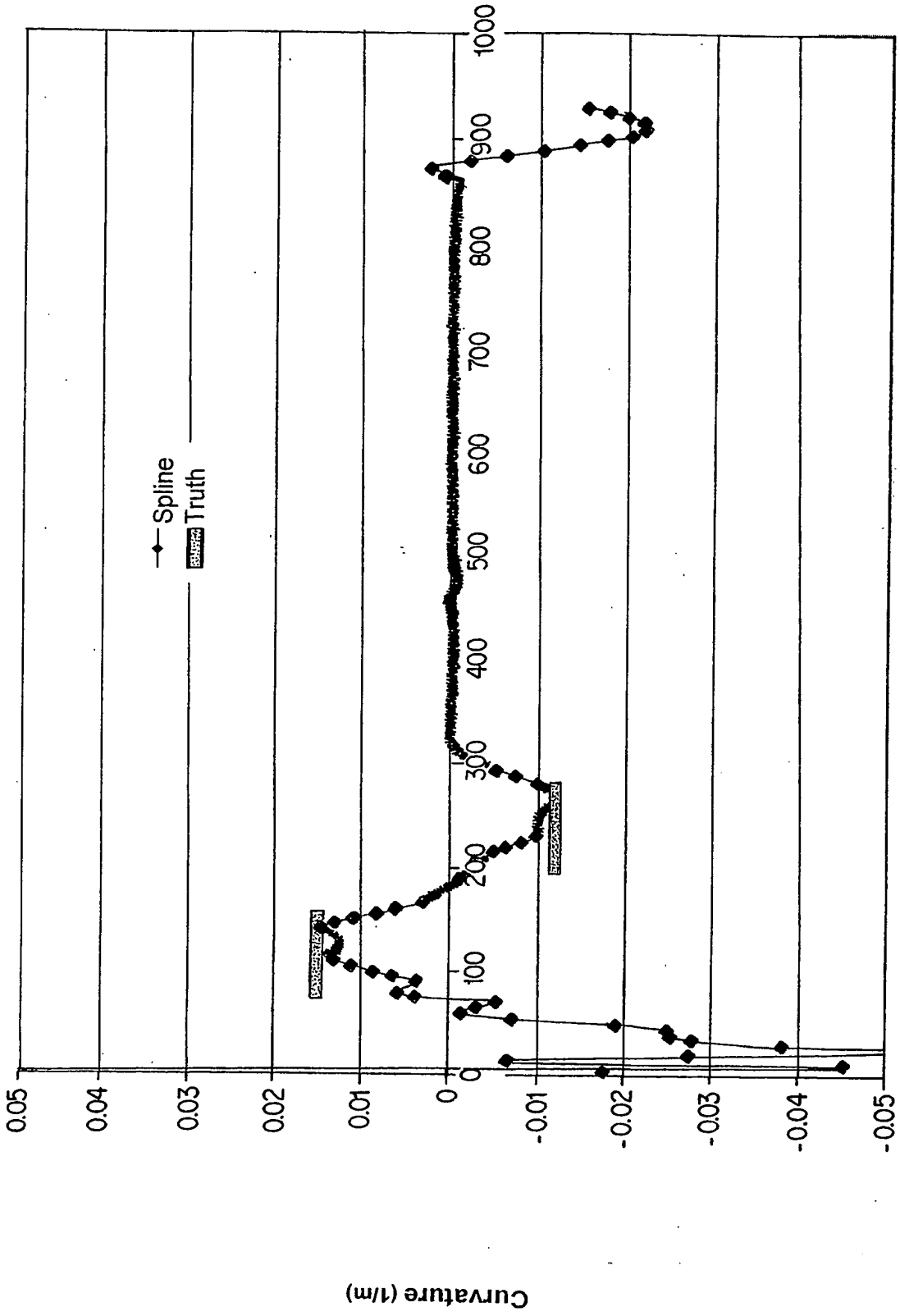

Spline
Truth
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
0
100
200
300
400
500
600
700
800
900
1000
Length along Segment (m)
Curvature (1/m)

FIG. 40

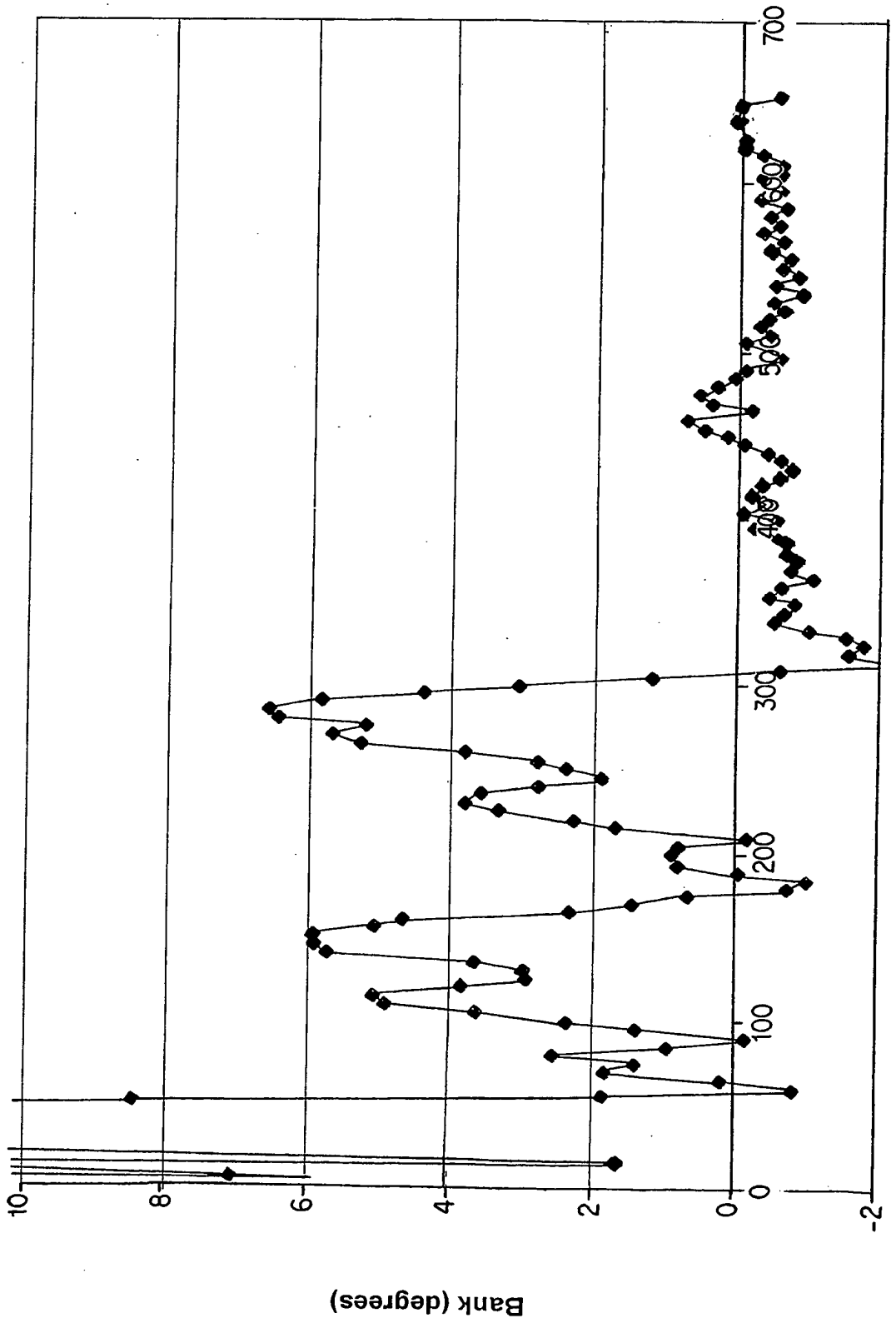

Bank (degrees)
10
8
6
4
2
0
-2
0
100
200
300
400
500
600
700
Length along Segment (m)

FIG. 41